

Air Force Civil Engineer Center



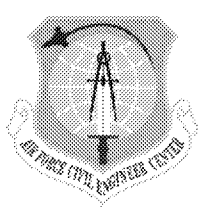
***FORMER
WILLIAMS AIR FORCE BASE***

Site ST012

**Former Liquid Fuel
Storage Area**

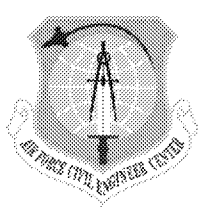
**BCT Meeting
14 February 2017**

Battle Ready...Built Right!



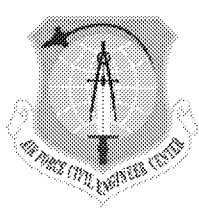
Site ST012 Outline

- **Summary of site activities**
- **SVE update**
- **Mass estimate update summary**
- **Temperature summary**
- **Groundwater concentration summary**
- **Additional characterization evaluation**
- **Comparison of EBR sulfate distribution to contamination distribution**
- **Path forward**

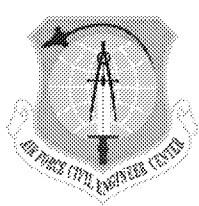


Site ST012 Activities Since January

- **Continued SVE operation**
- **Continued LNAPL screening in accessible SEE wells and Phase I characterization wells**
- **Continued installation and commissioning of containment system well pumps**



Soil Vapor Extraction System Update

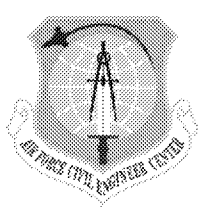


ST012 SVE System Update

- **Jul – Sep 2016**

- Flamox brought online 4 Aug
- 87.0% operational uptime
Thermox
- 70% operational uptime
Flameox
- Southern SEE CZ wells
screened with PID and CZ06
and CZ19 were connected to
SVE (Sep)
- Total petroleum hydrocarbon
(TPH) removed – 139,700
pounds or 21,260 gallons



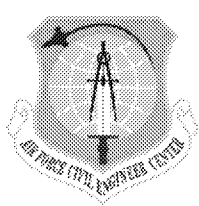


ST012 SVE System Update

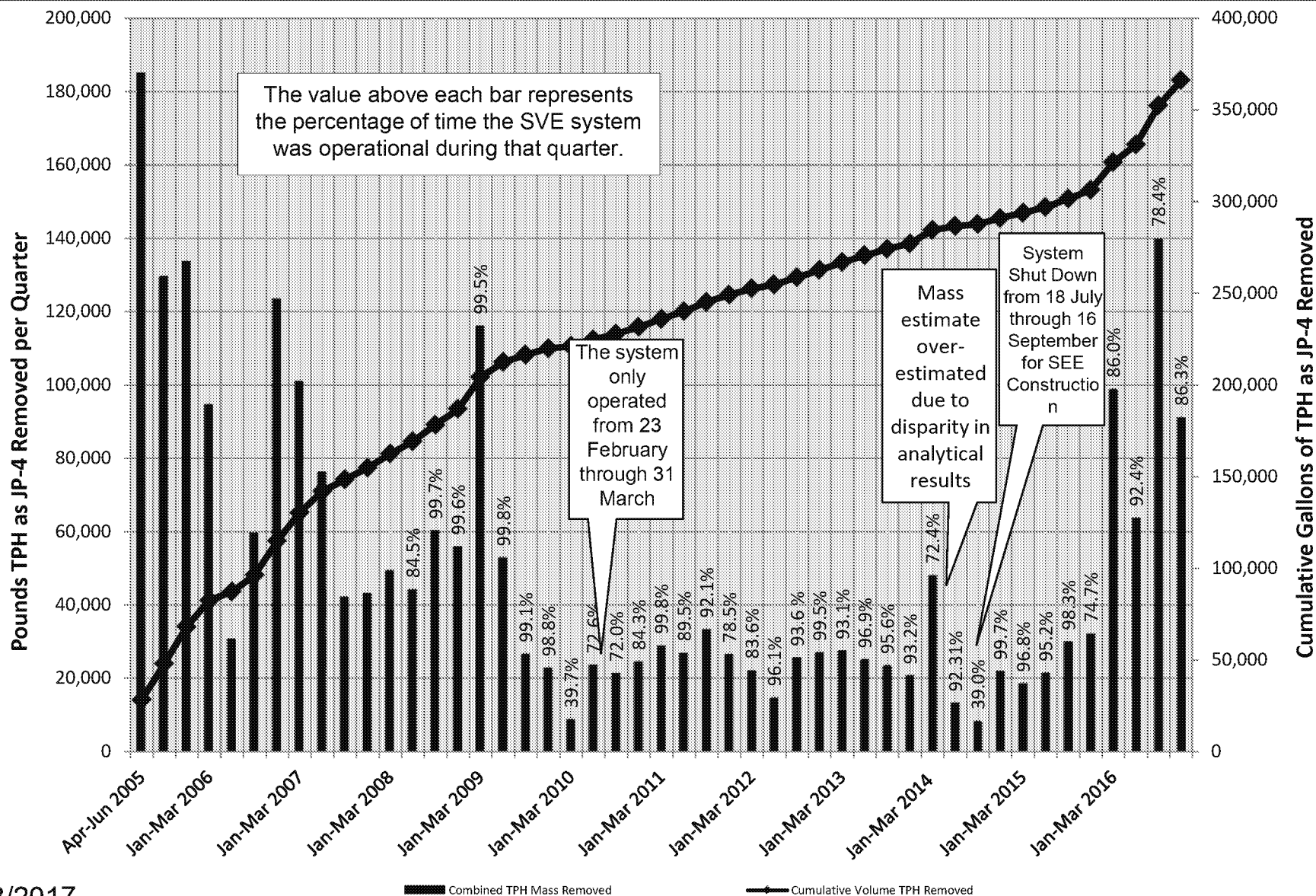
- **Oct – Dec 2016**

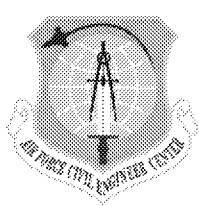
- 78% operational uptime
Thermox, (faulty LEL meter;
replacement backordered)
- 94% operational uptime
Flameox
- TPH removed – 90,900 pounds
or 13,840 gallons



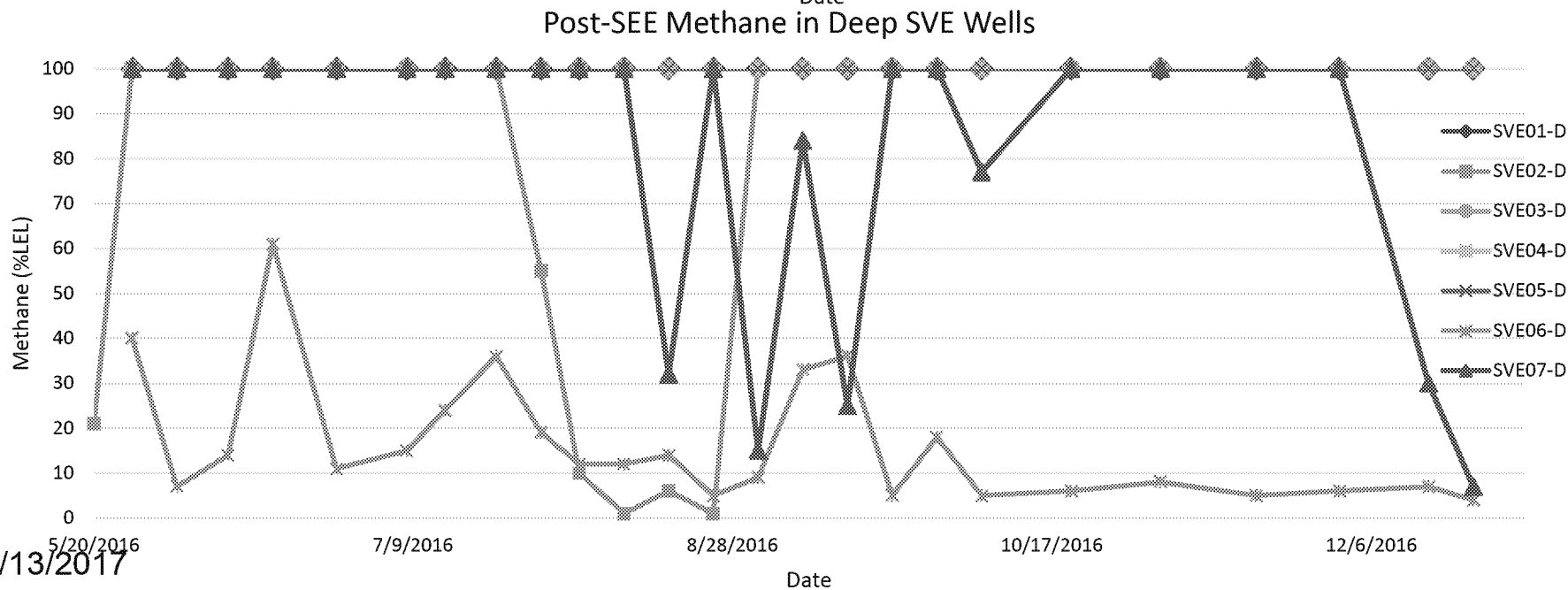
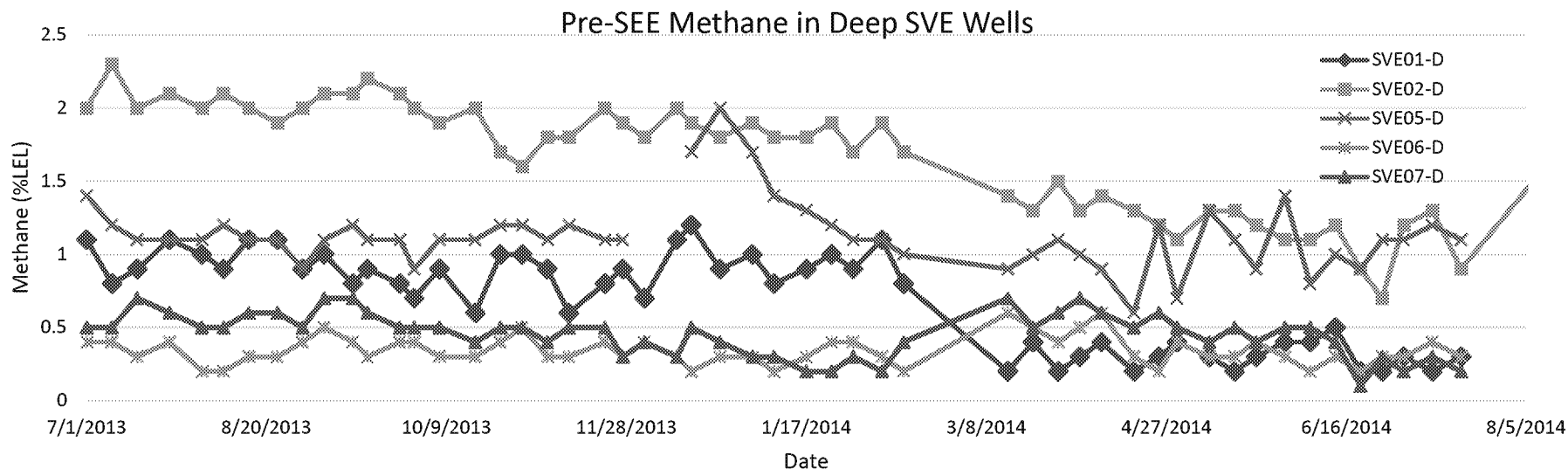


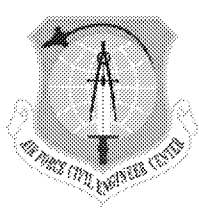
Site ST012 SVE System Performance





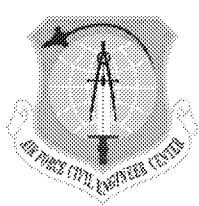
Site ST012 SVE System Methane





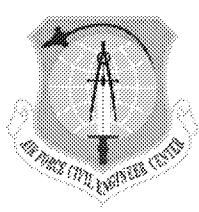
Site ST012 SVE System Summary

- **TPH removed through Dec 2016 – 366,000 gallons**
- **Mass removal increased significantly in Jan to Mar 2016 period following SEE treatment of CZ**
- **Similar mass removals have been sustained since SEE shutdown**
- **Methane concentration significant in deep wells (> 100% of LEL); an indicator of ongoing methanogenesis (anaerobic biodegradation)**

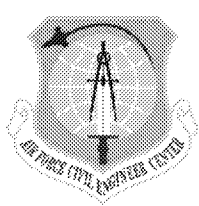


Site ST012 – EBR Applicability

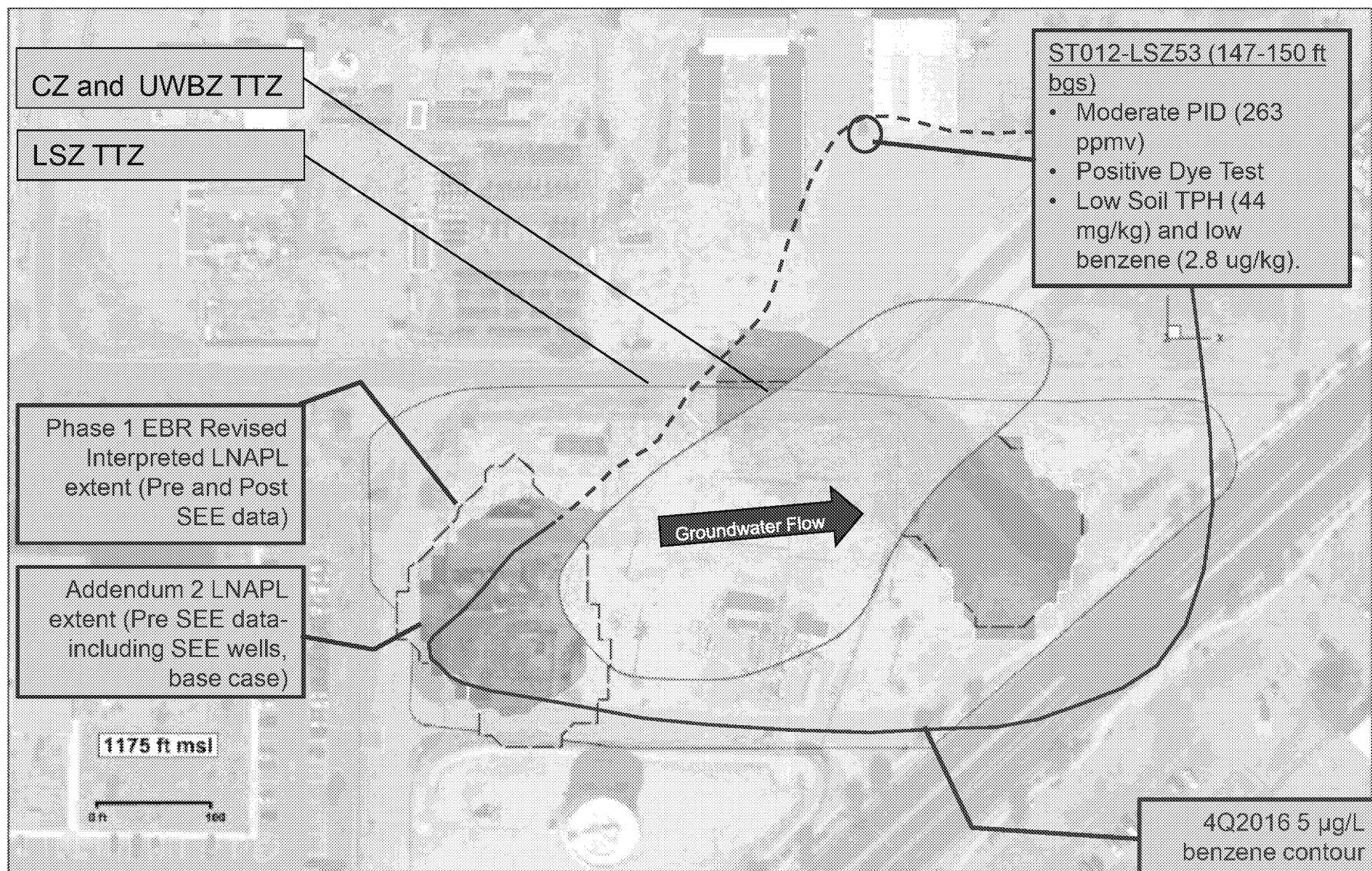
- There is no indication of downgradient LNAPL or dissolved contaminant migration
- Current estimates of mass remaining (equivalent of ~415,000 gallons) are less than EBR demonstration modeling in RD/RAWP (equivalent of ~483,000 gallons)
- Phase 1 EBR injections will target the vast majority of area of contaminant distribution as now understood
- The phased EBR approach provides the flexibility to start remediation on areas of highest known contamination and make adjustments to address additional areas discovered or areas with higher mass
- EBR enhances plume containment by increasing degradation of dissolved contamination at the downgradient perimeter
- Alternate sulfate supplier identified with no arsenic content
- Hydraulic containment pumping will degrade conditions for EBR by cooling and introducing more competing TEAs

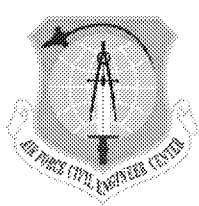


Mass Estimate Update

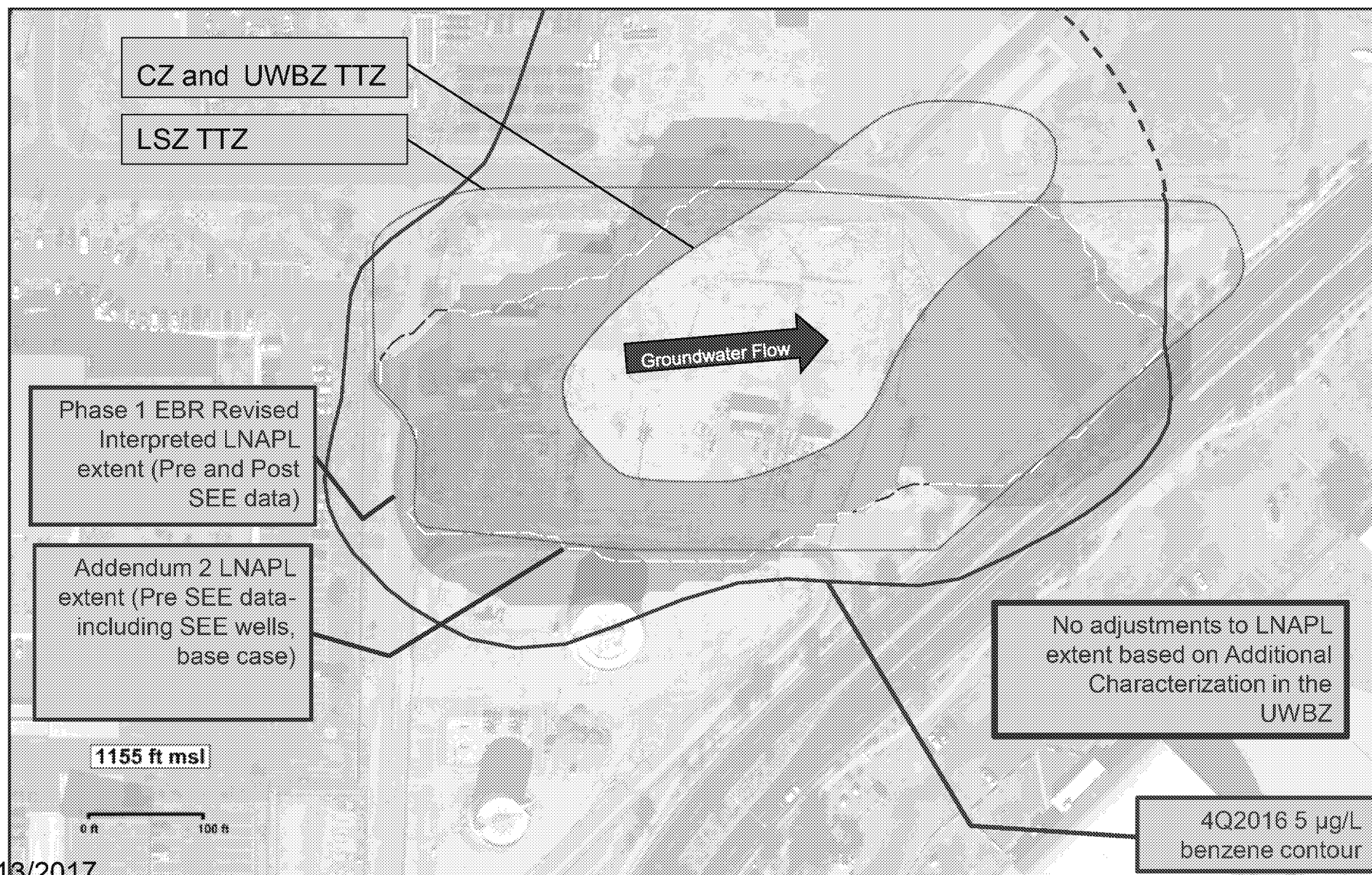


LNAPL Revised Interpretation Cobble Zone

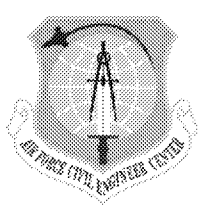




LNAPL Revised Interpretation Upper Water Bearing Zone

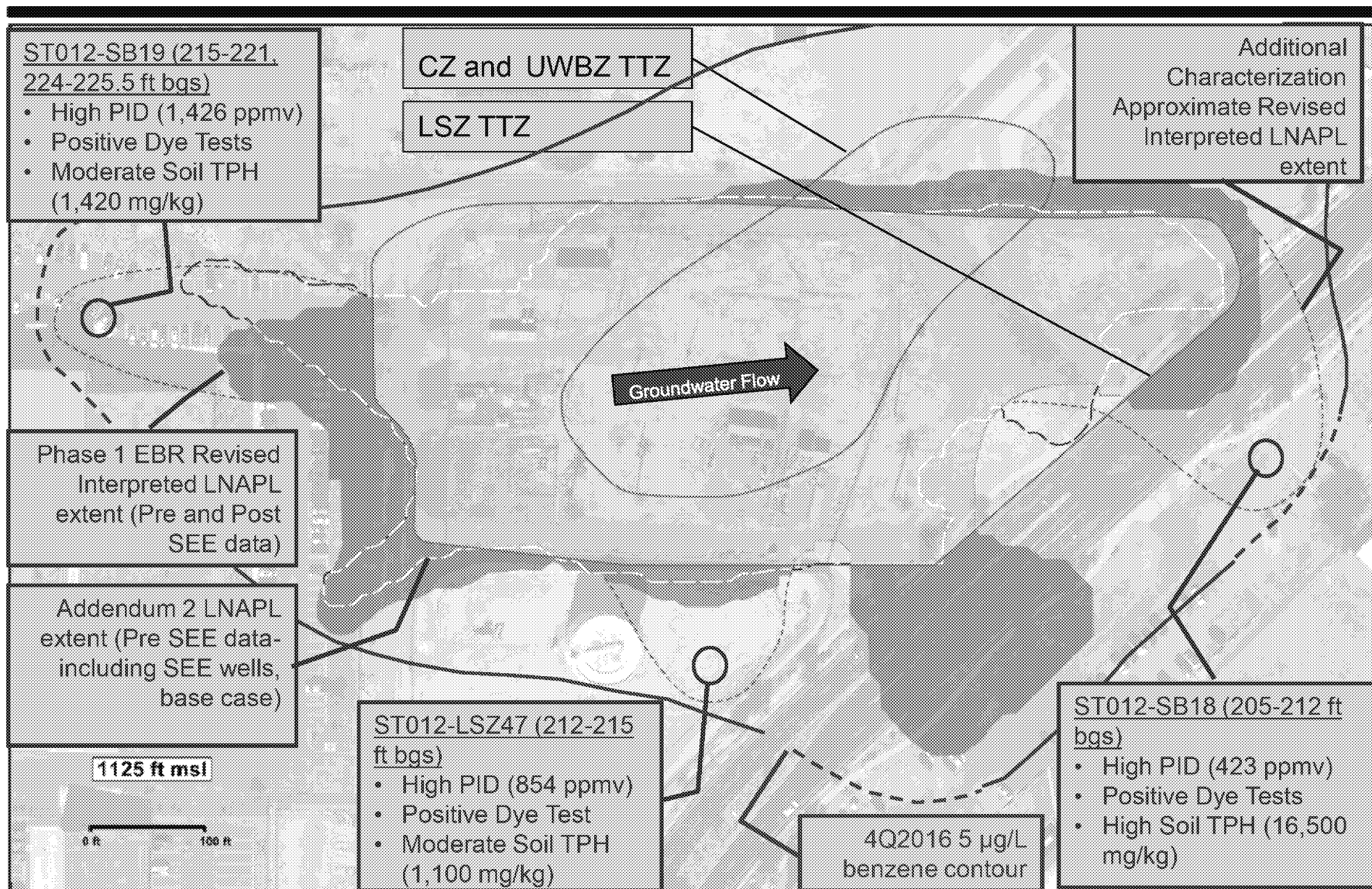


2/13/2017

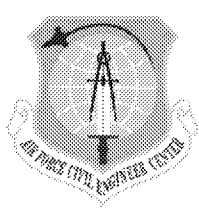


Revised LNAPL Interpretation

Lower Saturated Zone



2/13/2017



Revised LNAPL Mass Estimates

Mass Calculation Document/Phase	Estimated Remaining NAPL (gallons)				
	Total	TTZ	TIZ	ROI	EBR
RD/RAWP Appendix E - Post SEE ¹	483,000	---	---	---	---
Draft Final Addendum 2 ²	183,000	86,000	35,000	31,000	31,000
Revision Based on Incorporating Phase 1 EBR Data ³	377,000	55,000	44,000	134,000	144,000
Revision Based on Incorporating Add. Char. Data ⁴	415,000	55,000	44,000	134,000	182,000

Notes:

¹ Basis of EBR proof of concept in the Final RD/RAWP

² Calibrated estimate of mass removal and mass remaining used in EBR calculations

³ Calibrated estimate of mass removal and mass remaining incorporating Phase I results and revised interpretation of SEE treatment area extents.

⁴ Based on Phase 1 EBR update with additional volumes identified by investigation added to remaining contamination.

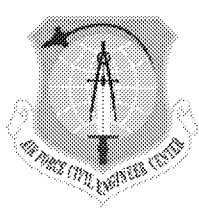
EBR - Enhanced Bioremediation

ROI - Radius of Influence

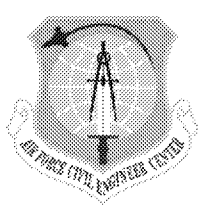
TIZ - Thermal Influence Zone

TTZ - Thermal Treatment Zone

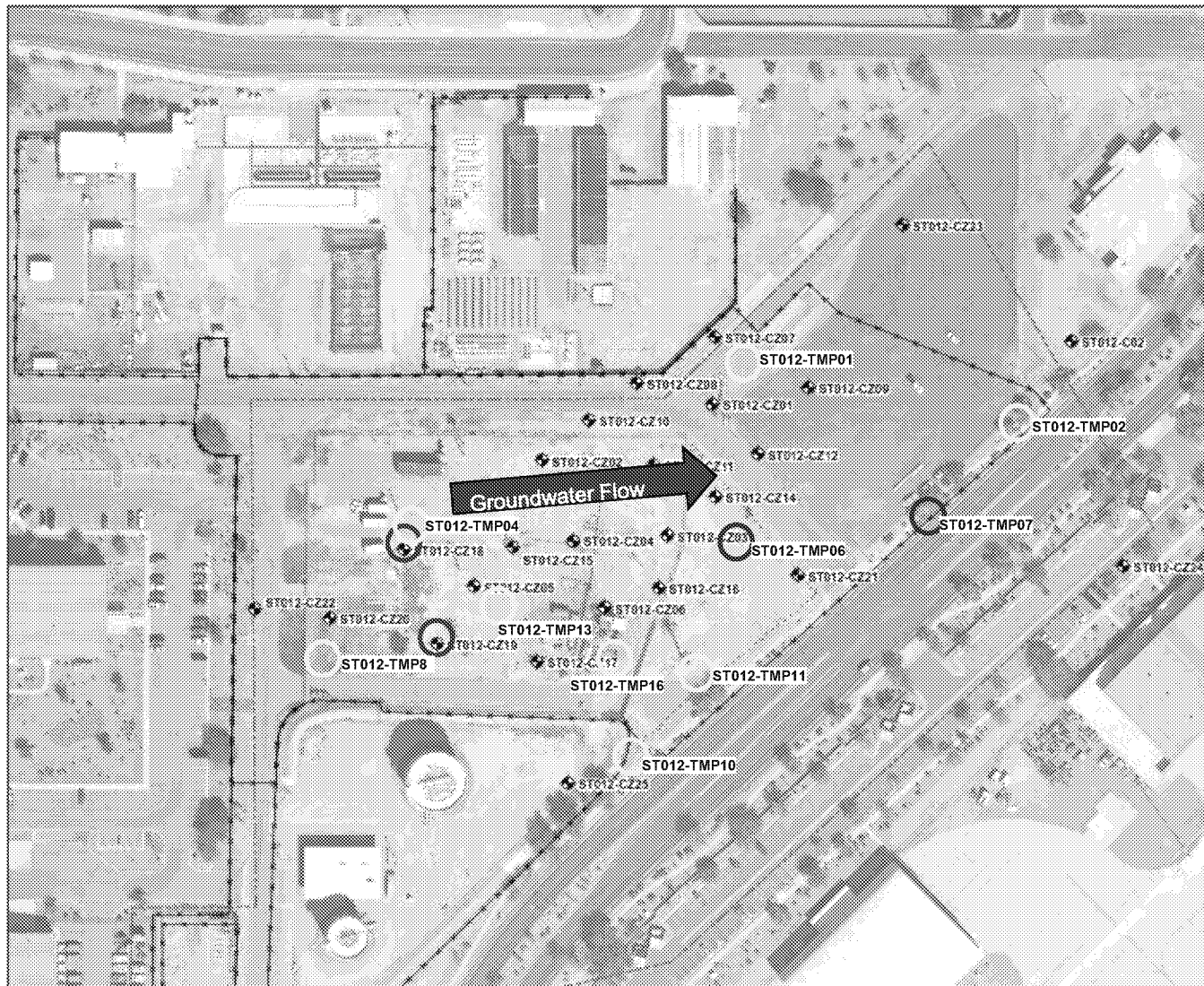
- Change from Draft Final Addendum 2 to Phase 1 EBR was due to LNAPL monitoring and removal data obtained within and on the perimeter of SEE TTZs (UWBZ and LSZ)
- Additional Characterization increased mass estimate by ~10%
- Estimate of mass remaining is less than estimate used in RD/RAWP EBR modeling



Temperature Monitoring

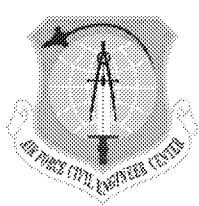


ST012 CZ Temperature Trends

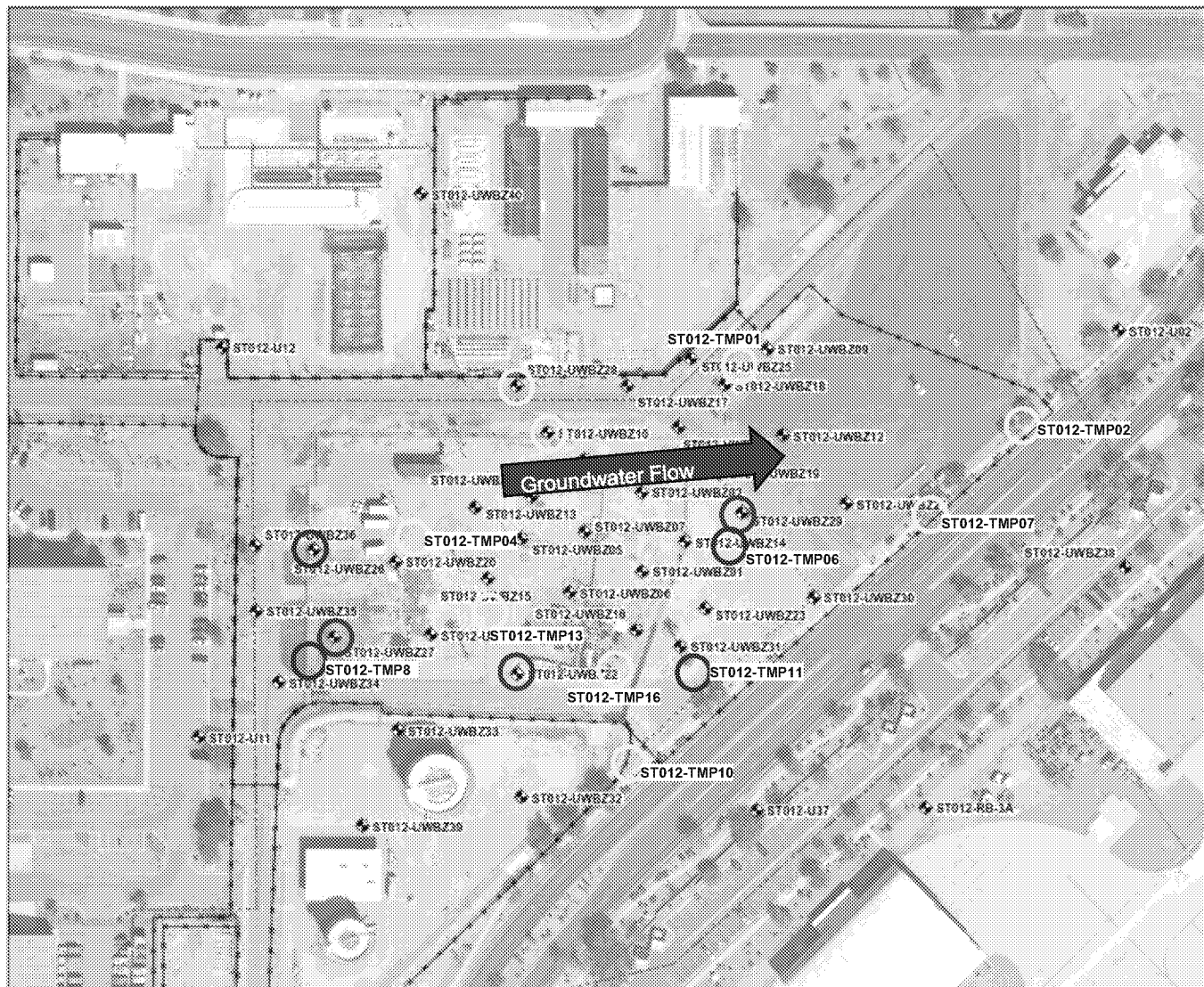


- >5°F temperature increase
- ≤5°F temperature change
- >5°F temperature decrease

- Average temperature across screened interval assessed

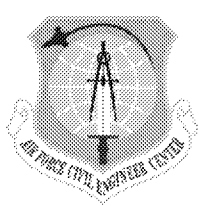


ST012 UWBZ Temperature Trends

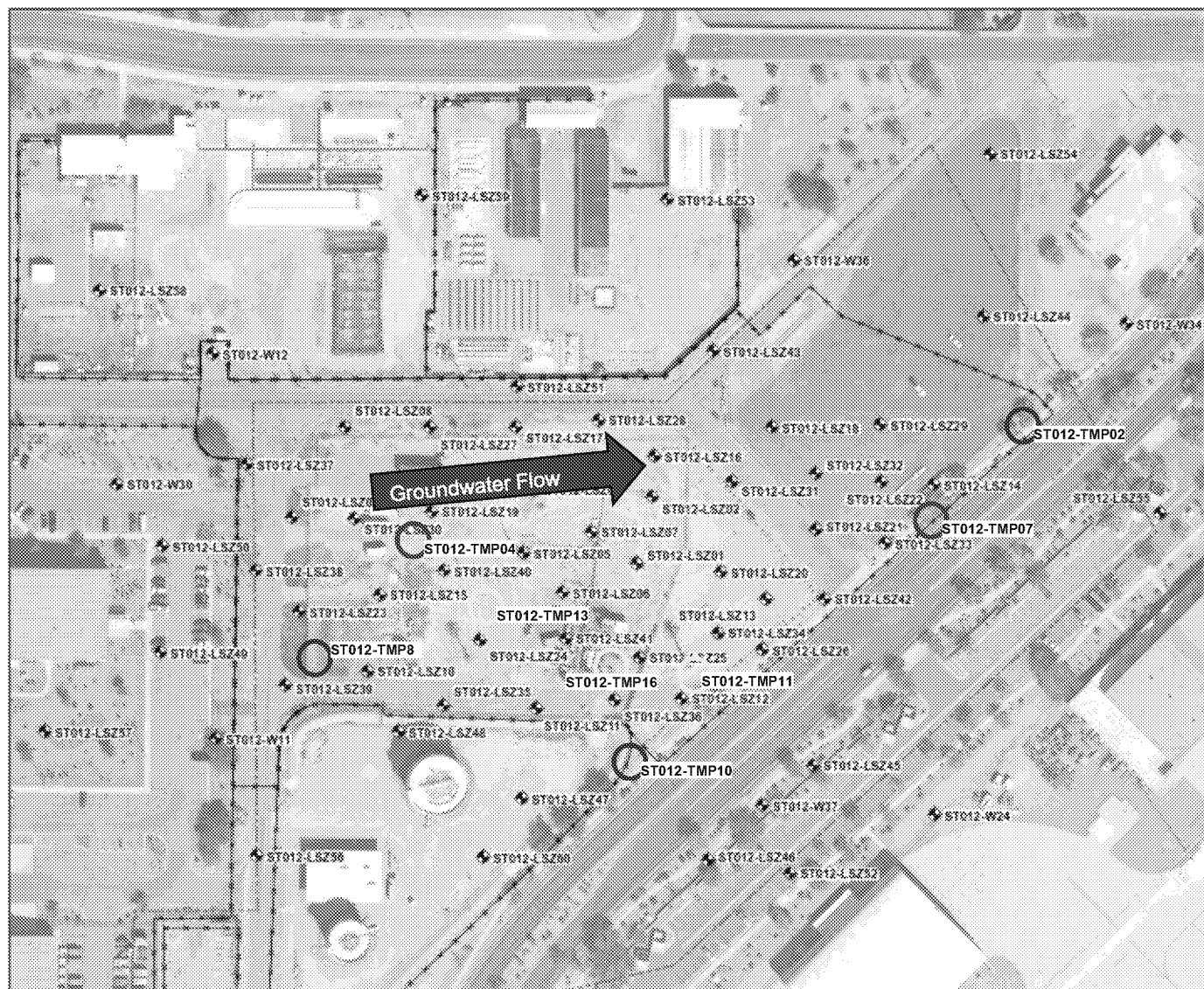


- >5°F temperature increase
- ≤5°F temperature change
- >5°F temperature decrease

- Average temperature across screened interval assessed

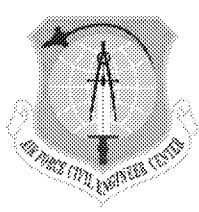


ST012 LSZ Temperature Trends

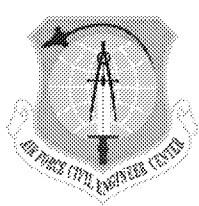


- >5°F temperature increase
- ≤5°F temperature change
- >5°F temperature decrease

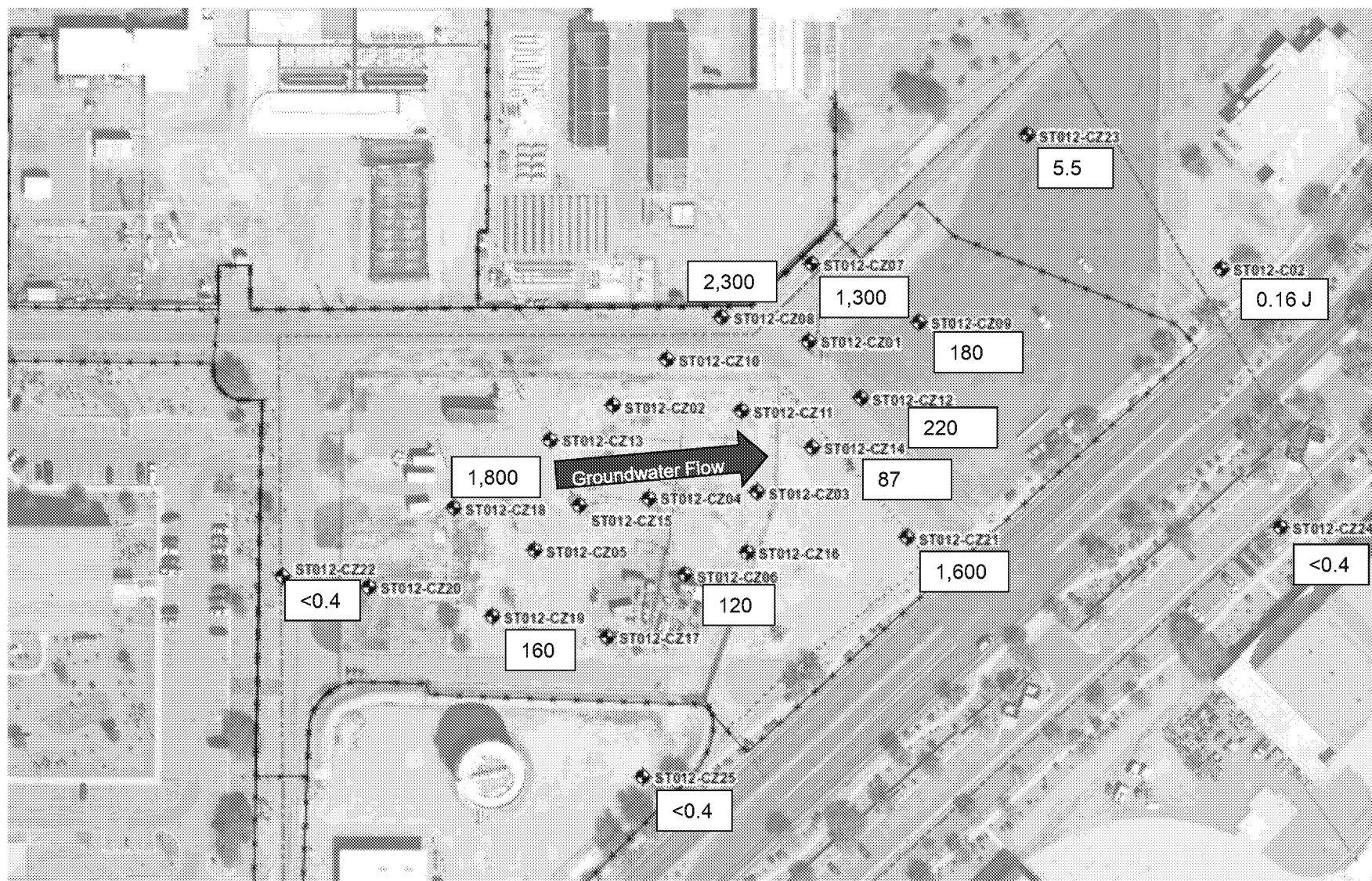
- **TMP (colored circles) average temperature across screened interval assessed**
- **Initial temperature readings in weekly reports (for ST012-LZ29 and ST012-LSZ 14) were from 200 feet; subsequent readings were calculated average temperature across screened interval**

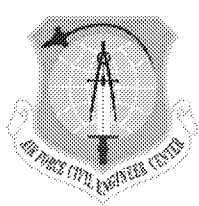


Groundwater Concentrations

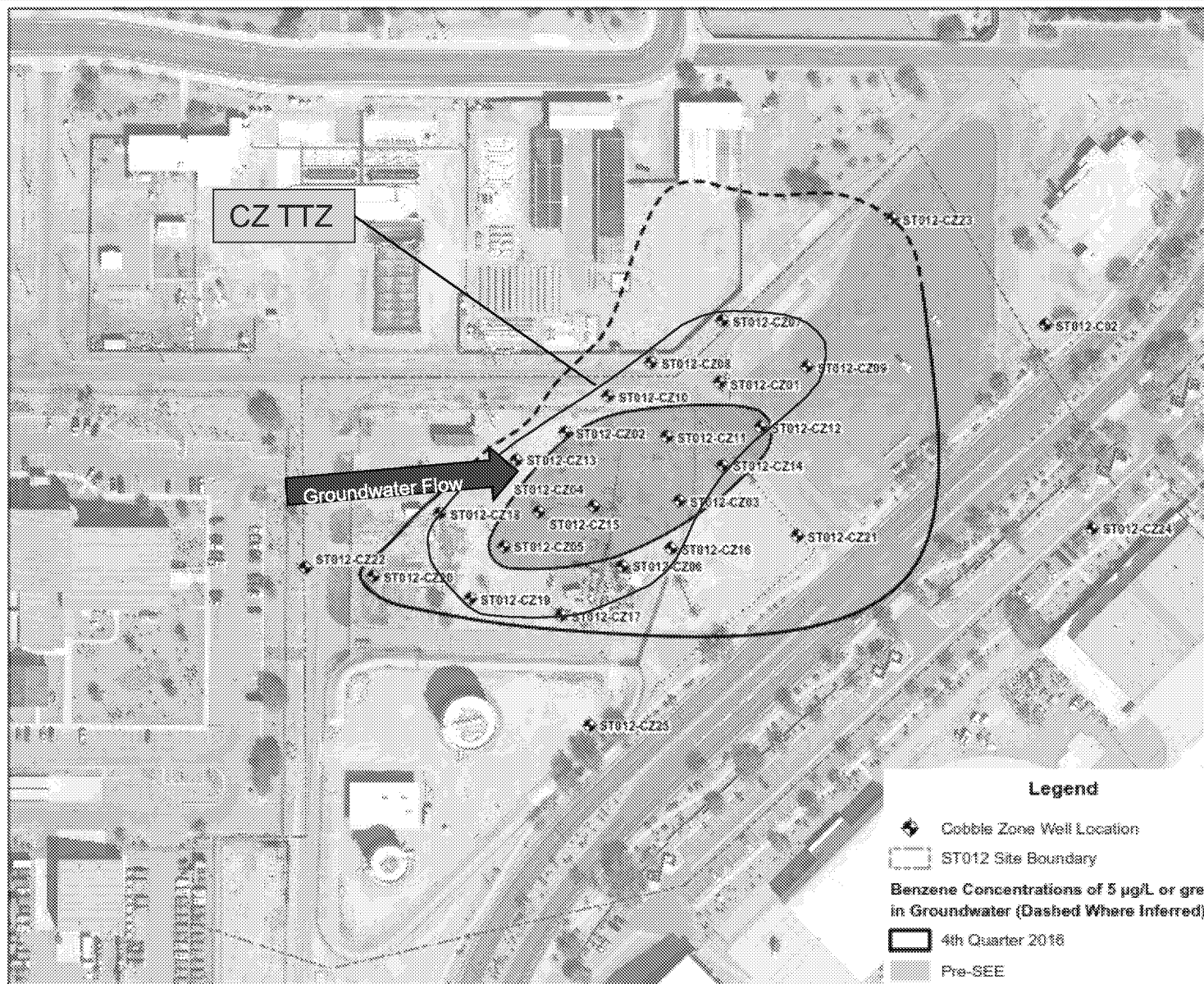


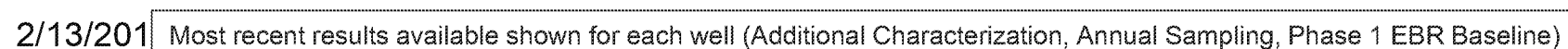
Site ST012 Additional Characterization CZ Groundwater Benzene Results ($\mu\text{g/L}$)

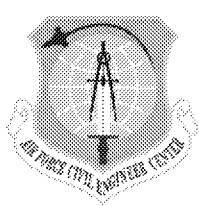




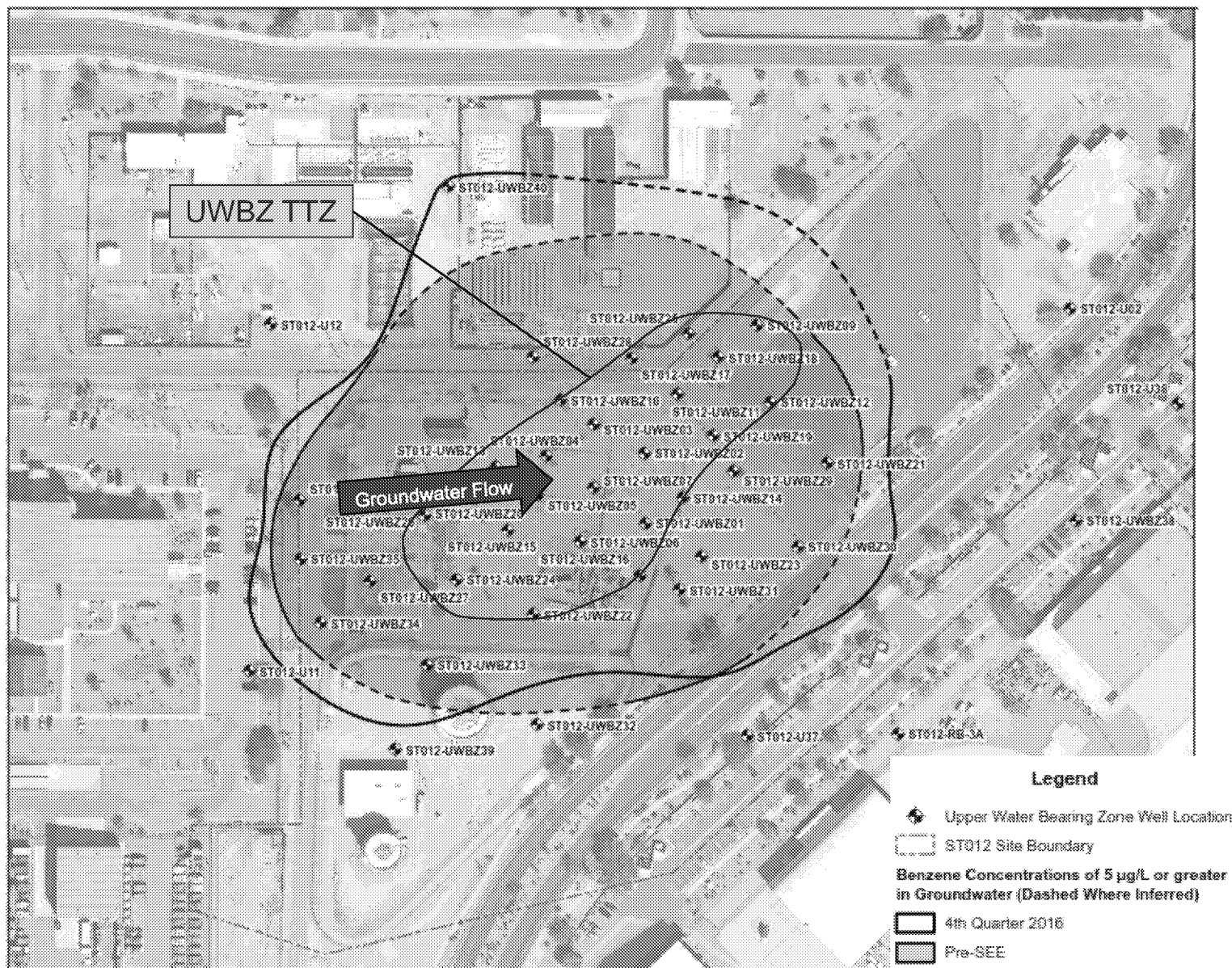
Site ST012 Pre-SEE/Post SEE Benzene ($5 \mu\text{g/L}$) Extent in CZ

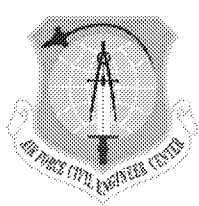




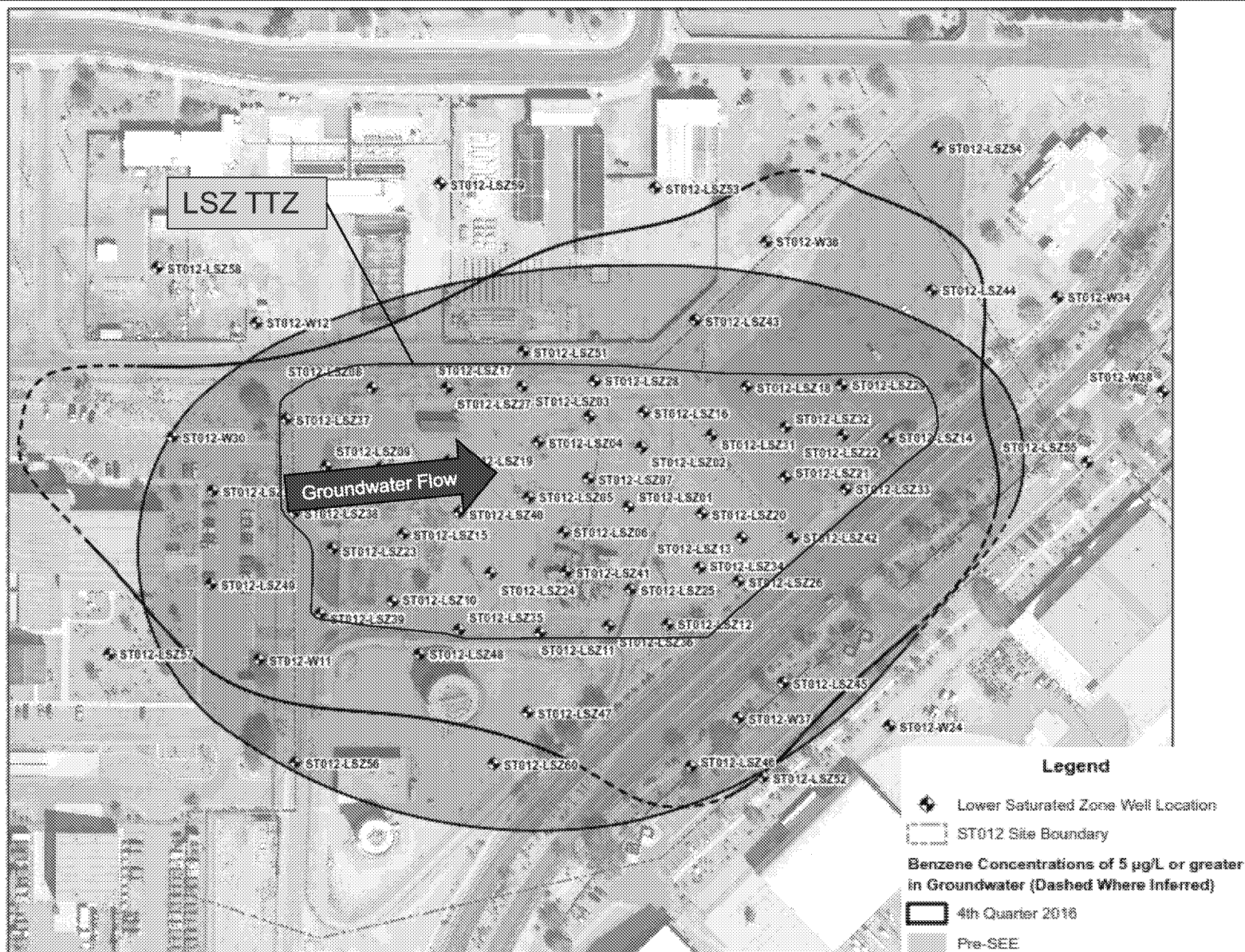


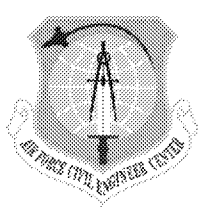
Site ST012 Pre-SEE/Post SEE Benzene ($5 \mu\text{g/L}$) Extent in UWBZ



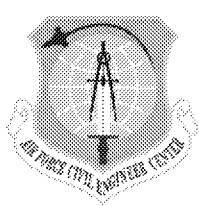


Site ST012 Pre-SEE/Post SEE Benzene (5 µg/L) Extent in LSZ

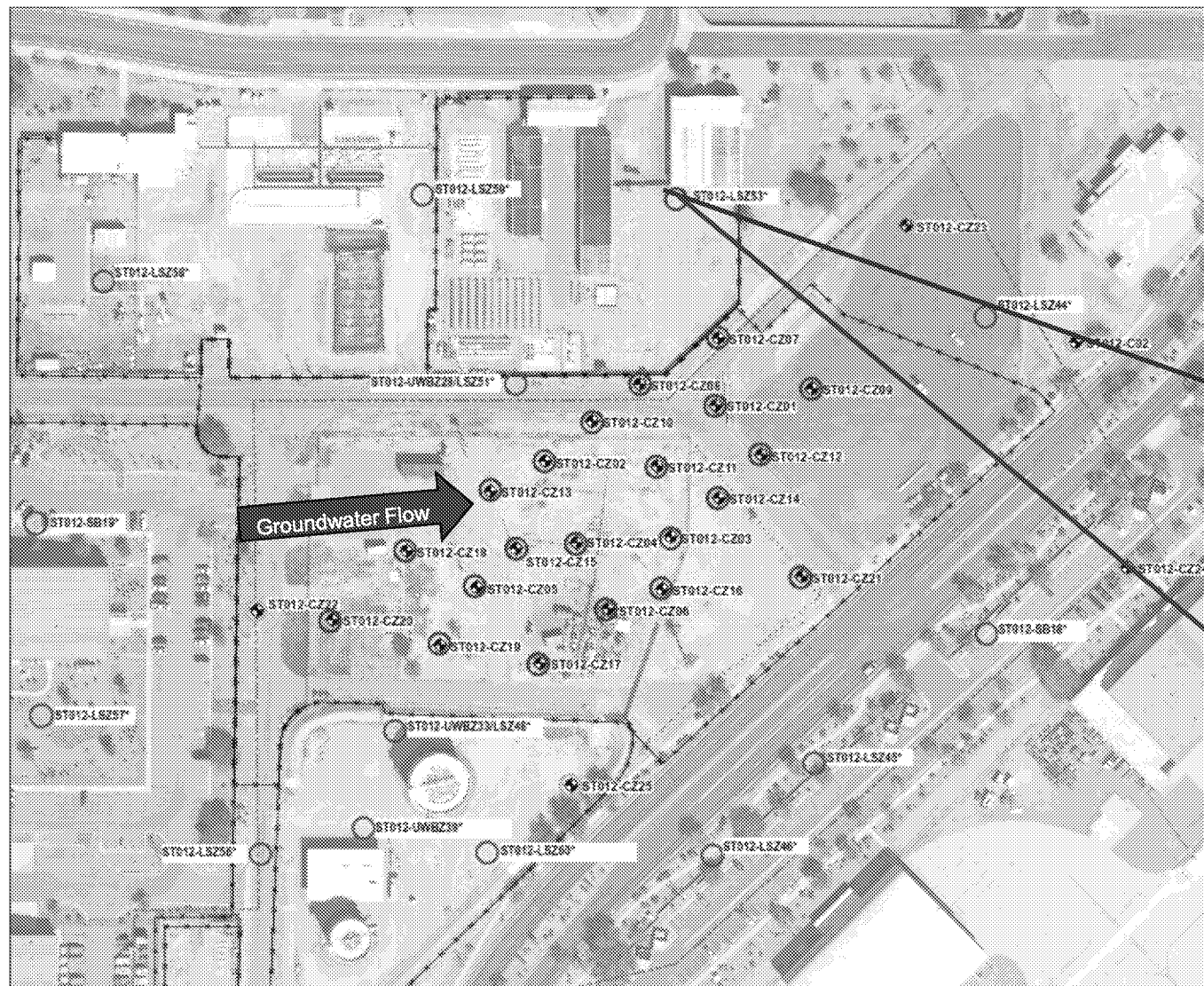




Characterization and Phase 1 EBR Implementation



ST012 FVM4 – CZ Characterization Evaluation



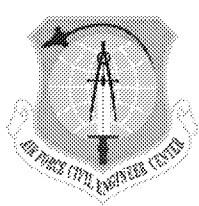
- Location of no LNAPL indications and no significant benzene concentrations (below to slightly above MCLs based on most recent data)
- Location of no LNAPL indications and suspected no significant dissolved phase benzene based on soil borings
- Location of known benzene impact (historical indication in SEE TTZ and >150 ppmv on PID or positive dye test in soil borings)

*Based on soil core observations in the CZ during drilling

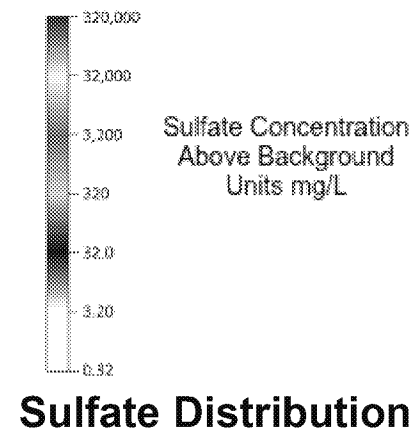
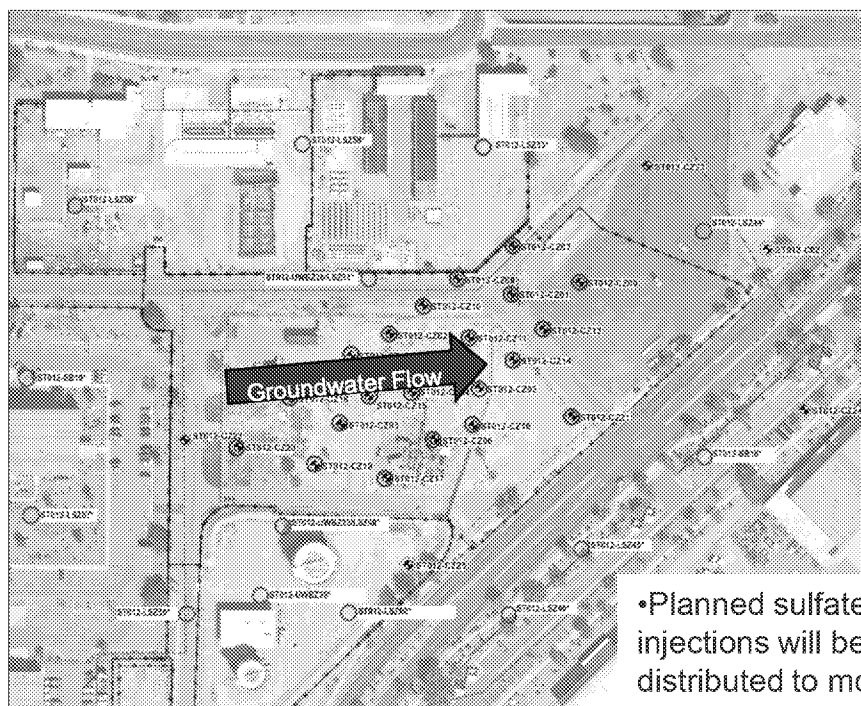
CZ mostly bounded. Positive dye test but analytical data indicated low TPH (44 mg/kg) and low benzene (2.8 ug/kg).

LNAPL/ dissolved phase extent will be treated in Phase 1 EBR

Possible location of future boring/well dependent Phase 1 EBR data



ST012 – CZ Characterization Compared to EBR Sulfate Distribution

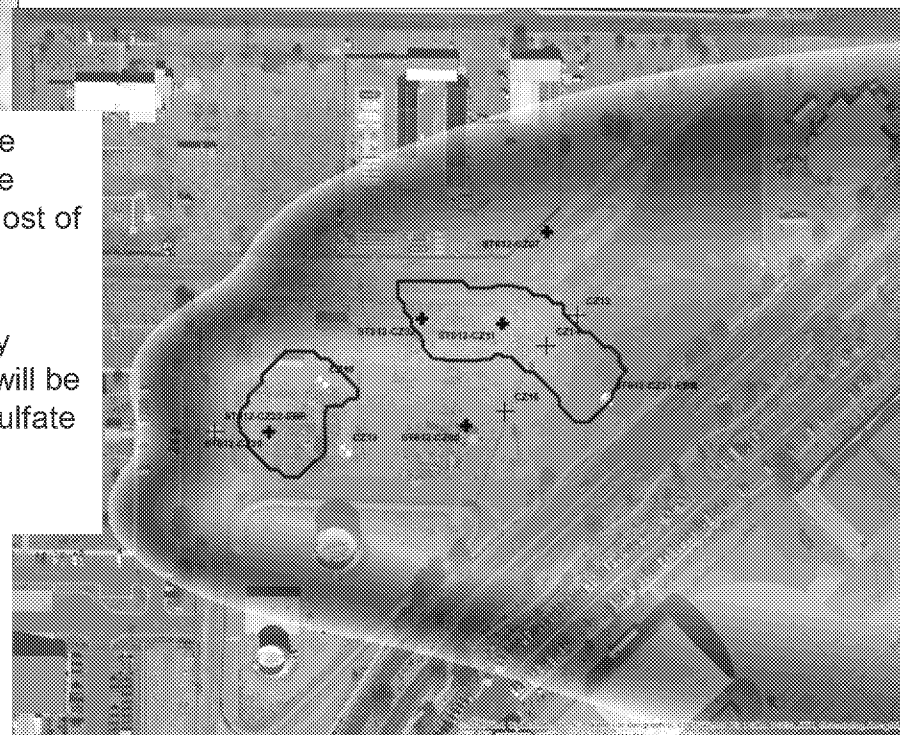


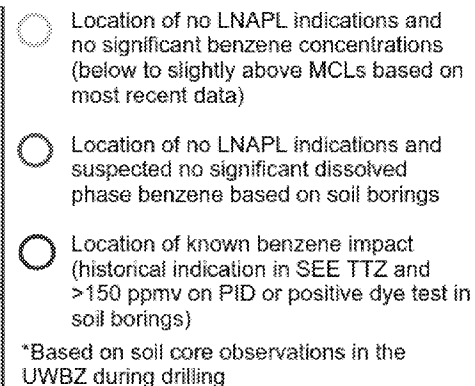
Characterization

- Location of no LNAPL indications and no significant benzene concentrations (below to slightly above MCLs based on most recent data)
- Location of no LNAPL indications and suspected no significant dissolved phase benzene based on soil borings
- Location of known benzene impact (historical indication in SEE TTZ and >150 ppmv on PID or positive dye test in soil borings)

*Based on soil core observations in the CZ during drilling

- Planned sulfate injections will be distributed to most of known CZ contamination
- Area in vicinity ST012-LSZ53 will be influenced by sulfate injections

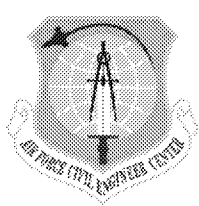




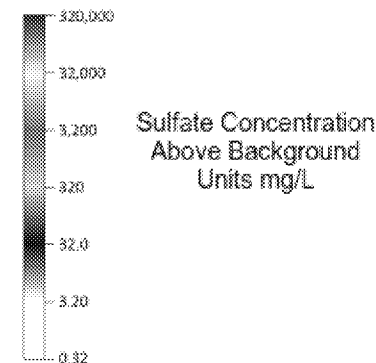
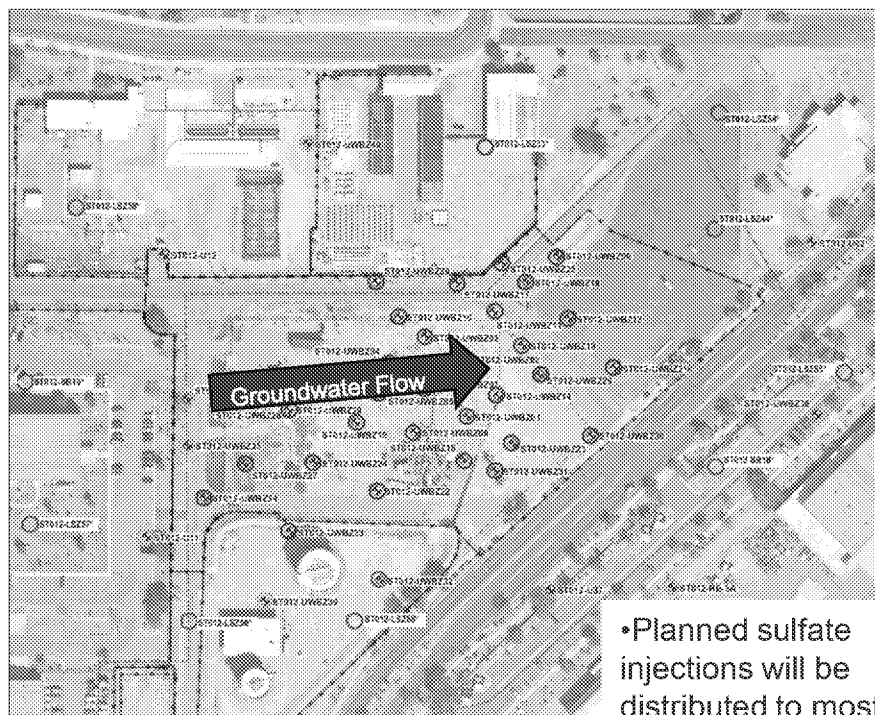
UWBZ mostly bounded Negative dye test, low TPH (14 mg/kg) low benzene 630 (ug/kg)

LNAPL/ dissolved
phase extent will be
treated in Phase 1
EBR

- Possible location of future boring/well (co-locate with CZ boring/well) dependent Phase 1 EBR data



ST012 – UWBZ Characterization Compared to EBR Sulfate Distribution



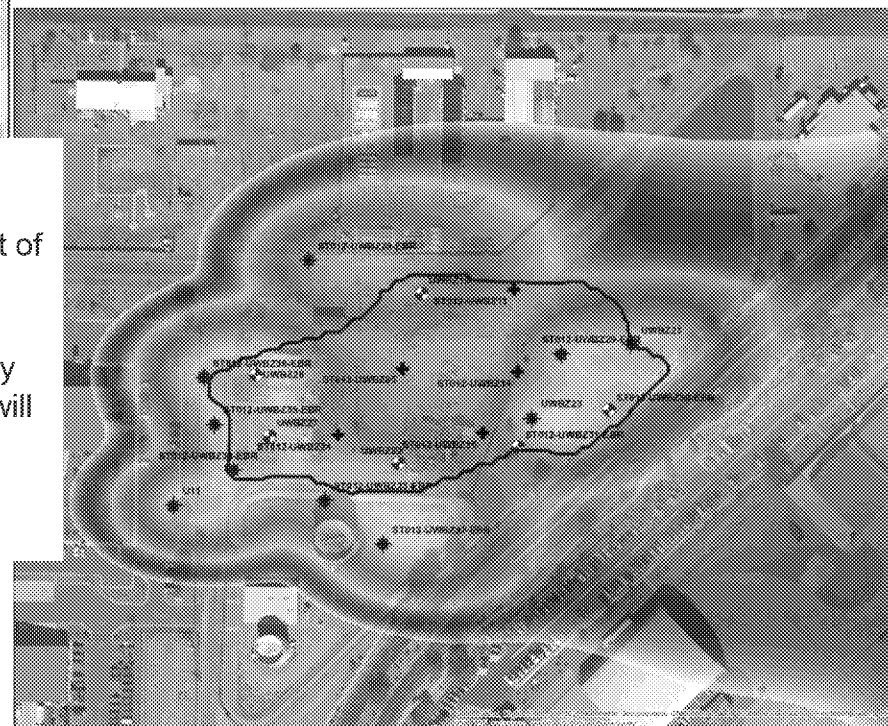
Sulfate Distribution

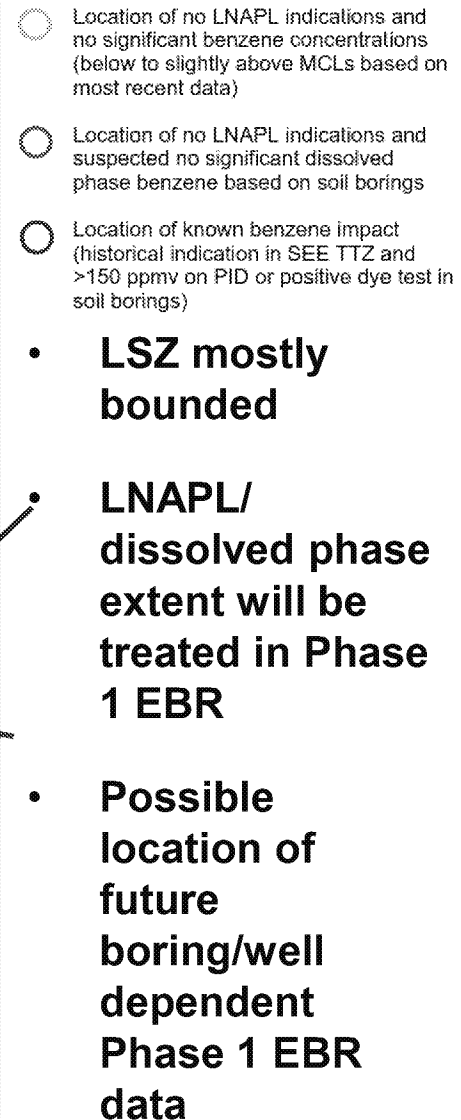
Characterization

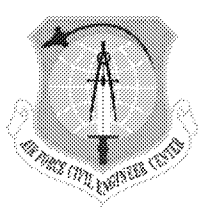
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- Location of no LNAPL indications and suspected no significant dissolved phase benzene based on soil borings
- Location of known benzene impact (historical indication in SEE TTZ and >150 ppmv on PID or positive dye test in soil borings)

- Planned sulfate injections will be distributed to most of known UWBZ contamination
- Area in the vicinity of ST012-LSZ53 will be influenced by sulfate injections

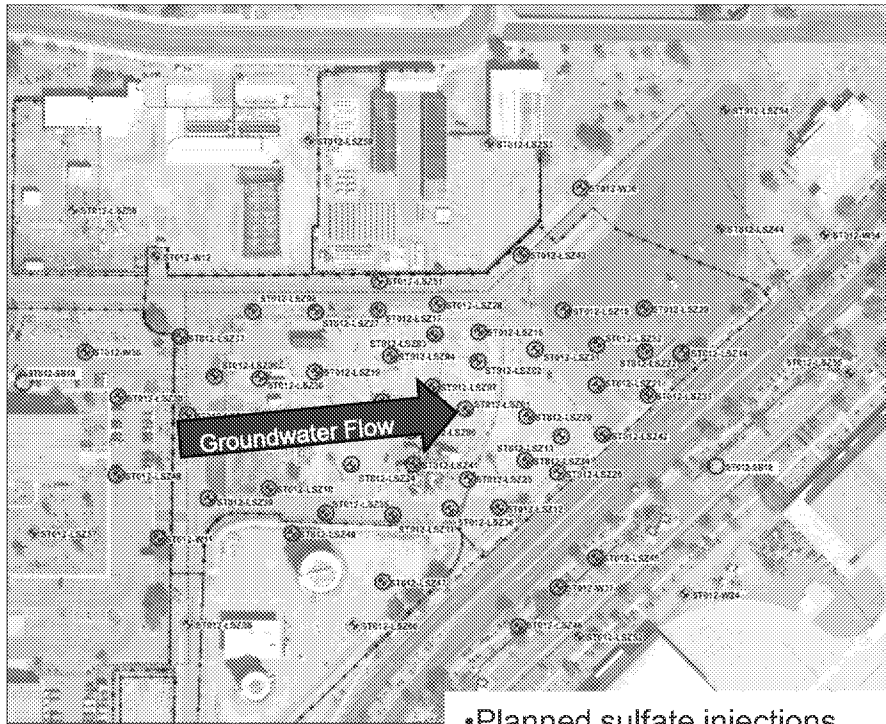
*Based on soil core observations in the UWBZ during drilling







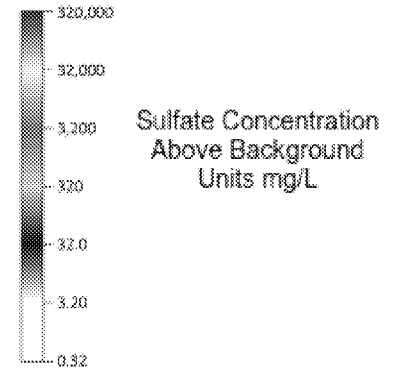
ST012 – LSZ Characterization Compared to EBR Sulfate Distribution



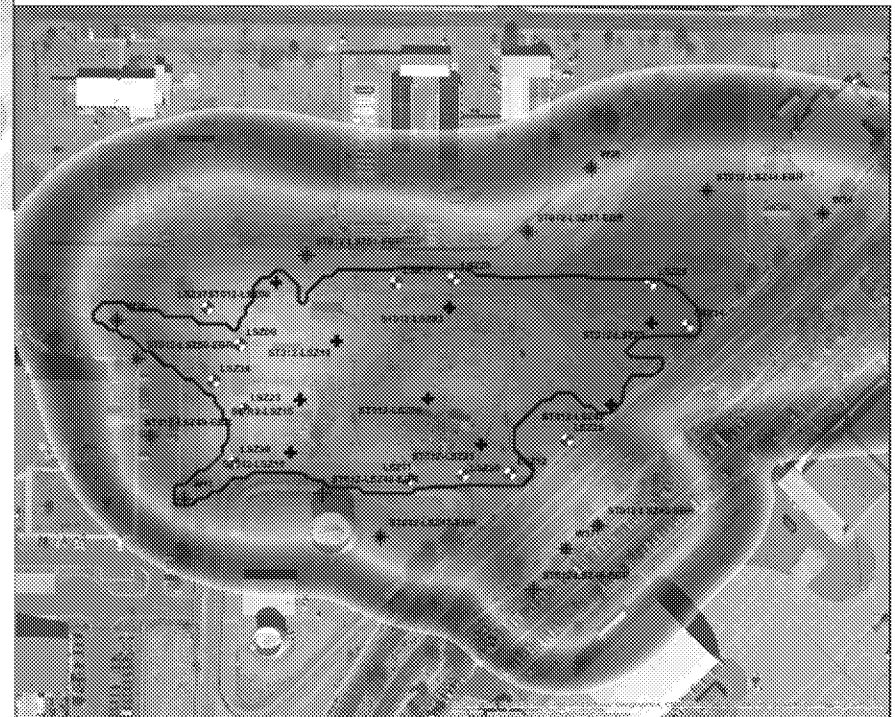
Characterization

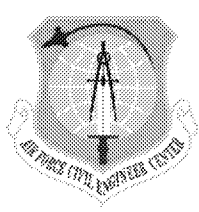
- Location of no LNAPL indications and no significant benzene concentrations (below to slightly above MCLs based on most recent data)
- Location of no LNAPL indications and suspected no significant dissolved phase benzene based on soil borings
- Location of known benzene impact (historical indication in SEE TTZ and >150 ppmv on PID or positive dye test in soil borings)

- Planned sulfate injections would have distributed to most of known LSZ contamination
- Area west of ST012-SB19 will be partially influenced by sulfate injections and may require higher sulfate delivery
- ST012-SB18 area may require higher sulfate delivery to address higher mass



Sulfate Distribution





Site ST012 – EBR Applicability

- There is no indication of downgradient LNAPL or dissolved contaminant migration
- Current estimates of mass remaining (equivalent of ~415,000 gallons) are less than EBR demonstration modeling in RD/RAWP (equivalent of ~483,000 gallons)
- Phase 1 EBR injections will target the vast majority of area of contaminant distribution as now understood
- The phased EBR approach provides the flexibility to start remediation on areas of highest known contamination and make adjustments to address additional areas discovered or areas with higher mass
- EBR enhances plume containment by increasing degradation of dissolved contamination at the downgradient perimeter
- Alternate sulfate supplier identified with no arsenic content
- Containment pumping will degrade conditions for EBR by cooling and introducing more competing TEAs

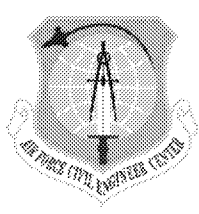
Air Force Civil Engineer Center

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WILLIAMS AIR FORCE BASE*

**Site LF004 Landfill
Remedial Action**



**BCT Meeting
14 February 2017**



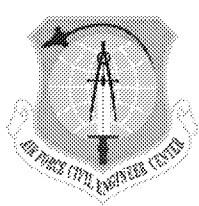
Site LF004

Former AST SVE System Update

Operations Summary through 3 Feb 2017

- Installed vapor monitoring probe (VMP11-D) south of SVE6-D in Aug 2016
- A grab groundwater sample collected approximately 5 ft. below the air water interface during drilling of VMP11-D indicated TCE concentrations of 0.24 µg/l in groundwater
- Analytical data (Dec 2016) indicates TCE and PCE concentration remained below soil vapor goals (SVSLs) in all SVE wells and VMPs except TCE in SVE6-D (2.4 mg/m³ vs 2 mg/m³) and VMP11-D (6.2mg/m³ vs 2 mg/m³)
- TCE in SVE6-D and VMP11-D decreased from 2.6 in Sep to 2.4 (Dec) and 13 in Sep to 6.2 (Dec), respectively
- VMP11-D connected to SVE system on 12 Oct 2016. Initial PID reading decreased from 1,053 ppmv to 27 ppmv. Current PID readings continue to decrease and are currently 18.4 ppmv. 0.4 pounds removed since 6 Jan 2017.

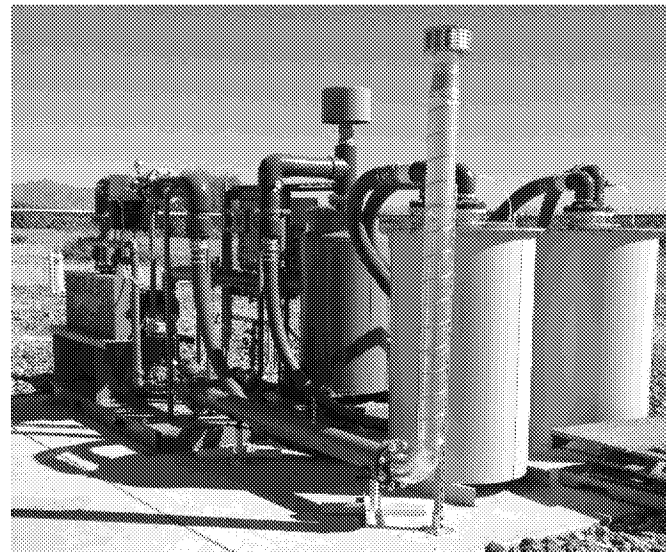


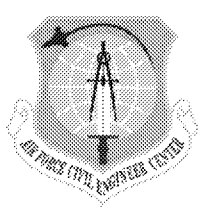


LF01-W17 Area IWAS System Update

Operations Summary through 3 Feb 2017

- Began operation 29 Aug 2014
(approximately 22 months of operation)
- Average 99% operational uptime for reporting period
- TCE and PCE concentrations in extracted vapor are 57 and 71 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), respectively (Dec 2016); extracted vapor concentrations remain low.
- Estimated 10.9 pounds of TCE and PCE removed by vapor extraction
- Oxidant screening indicates residual oxidant concentrations range from approximately 1 mg/L to 36 mg/L.
- All remediation wells operating following repair of RW01A and RW01D
- Nov PDB results indicate only W17S and W17M were above MCLs at 5.8 $\mu\text{g}/\text{l}$ and 8.1 $\mu\text{g}/\text{l}$ for TCE



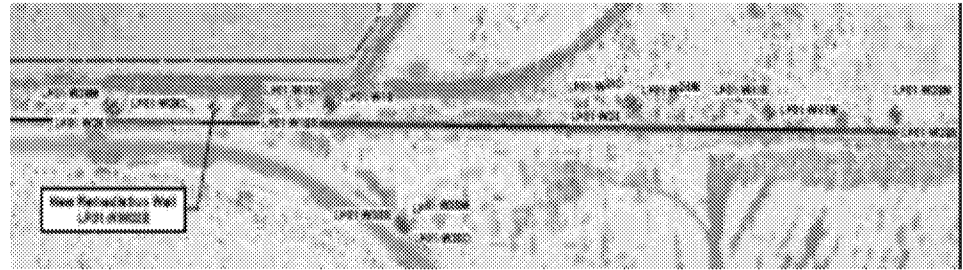


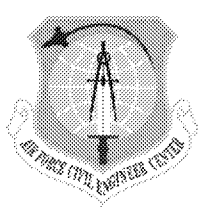
Site LF004

Southern Area Oxidant Injection

Activity Summary through 6 Jan 2017

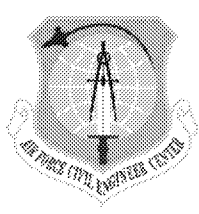
- Began operation 15 Sep 2014 (approximately 22 months of operation)
- Field screening of residual oxidant ongoing. Oxidant concentrations were approximately 1 mg/L in LF01-W19 area and 6 to 24 mg/L in LF01-W24 area at beginning of Jan 2017
- Preliminary Nov PDB results indicate only three PCE MCL exceedances: W19S 13 µg/l (12 µg/l dup), W24S at 6.4 µg/L and W24M at 6.2 (5.4 dup) µg/l
- Shallow remediation well (LF01-RW02E) groundwater sample results pending





LF004 OPS Update-Regulatory Comments

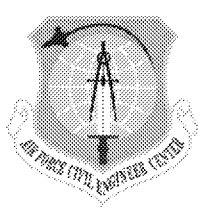
- Received EPA comments for LF004 OPS report on Jan 24, 2017
- Received ADEQ comments for LF004 OPS report on Feb 6, 2017
- Three main EPA comment categories
 - Rejects that remedy is operating properly and successfully
 - Additional site characterization for PFASs in groundwater
 - Clarification regarding data presentation, time required for remedy to attain remedy objectives, evaluation of possibility may not achieve remedy objectives, and remedy contingency planning
- ADEQ main comments indicate
 - ADEQ understands the objective of the OPS report is solely for the purpose of property transfer,
 - acknowledges that on balance the remedy is operating properly and successfully
 - Additional site characterization for PFASs in groundwater
 - Clarification regarding recent remedy optimization (installation of remediation well)



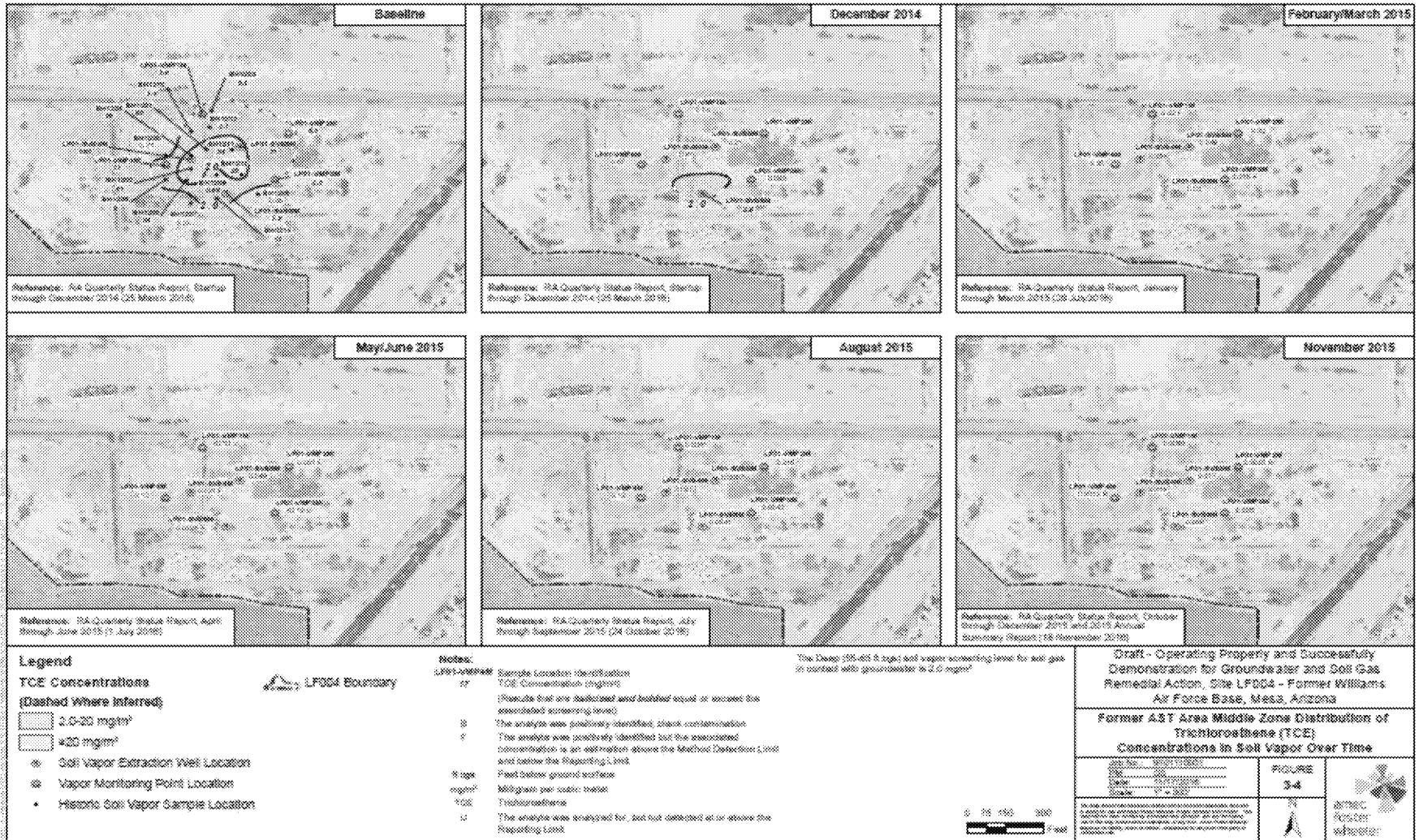
LF004 OPS Update-EPA Comments

- **Rejects the conclusion that remedy is operating properly and successfully at this time.**
- **AF Response**
- ***Objective of OPS report is for property transfer***
- ***TCE and PCE vapor plume footprints reduced by 99%. Greater than 127 pounds of VOCs (TCE and PCE removed). Rebound testing and post remediation vapor monitoring indicate all VMPs and SVE wells below SVG except for two locations.***
- ***TCE and PCE groundwater plume footprints reduced by approximately 80% via IWAS treatment and chemical oxidation. Greater than 15 pounds of VOCs (TCE and PCE) removed from groundwater via IWAS treatment.***
- ***Recent Installation of remediation well is optimization of existing remedy***
- ***EPA analysis of baseline conditions fails to take into account that pre-design pilot study was performed at LF01-W19 which reduced initial PCE concentrations to below MCLs***
- ***EPA analysis of persistent concentrations of PCE at LF01-W19 is not consistent with site data indicating fluctuating concentrations since remedy implementation***

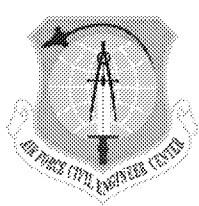




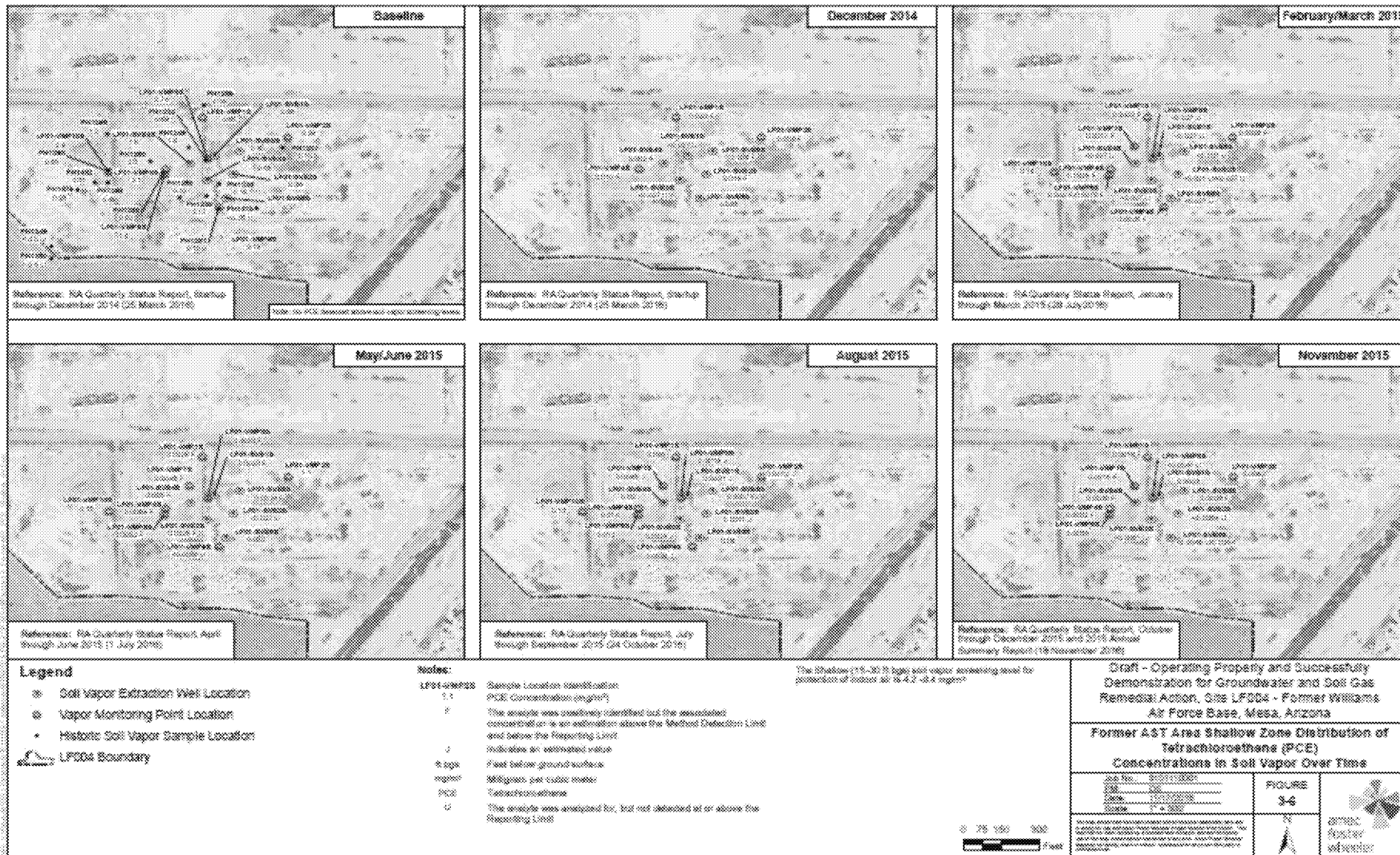
LF004 OPS Update-EPA Comments

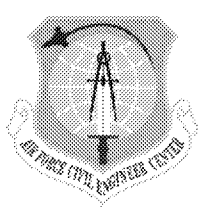




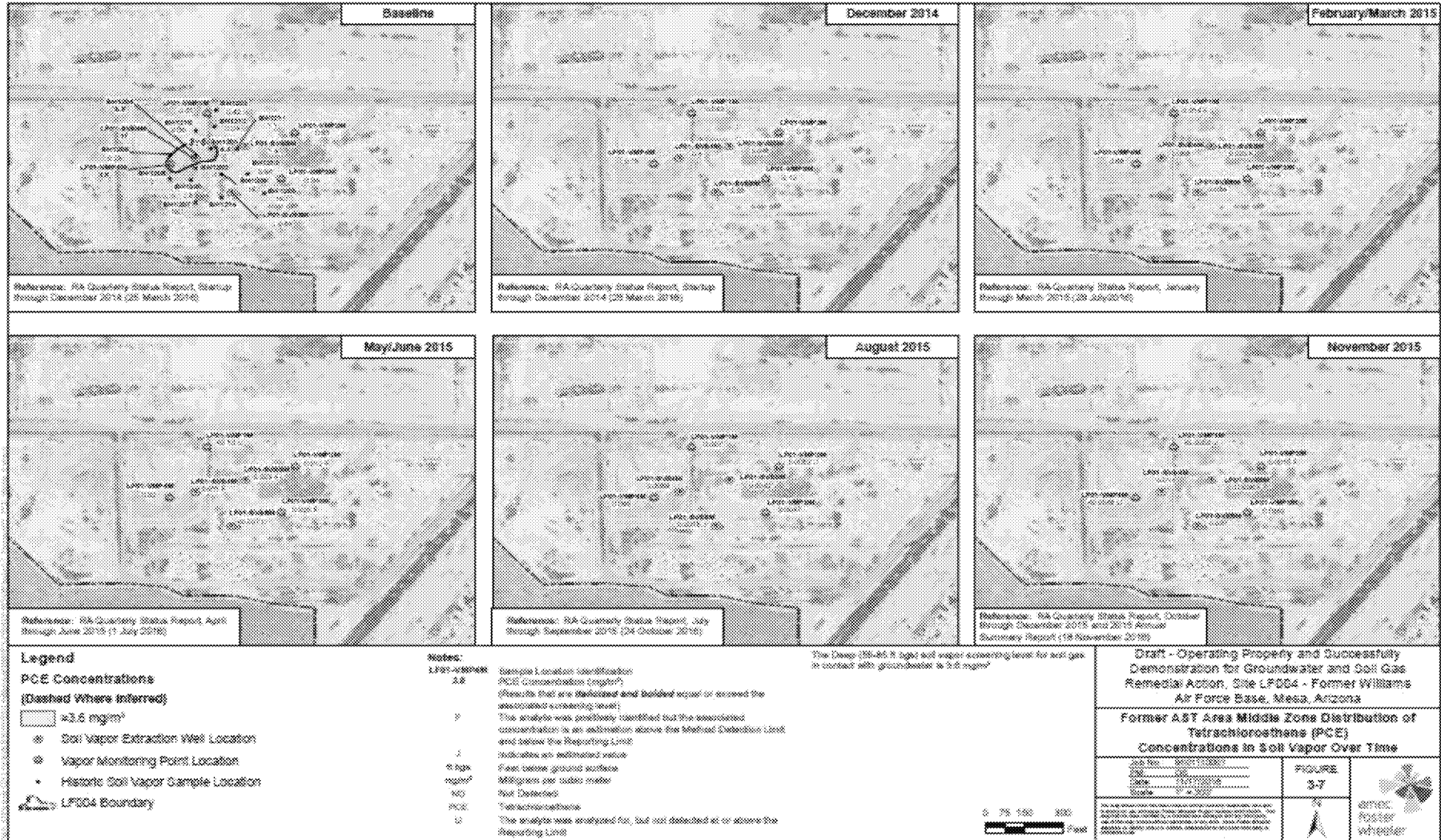


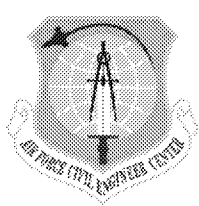
LF004 OPS Update-EPA Comments



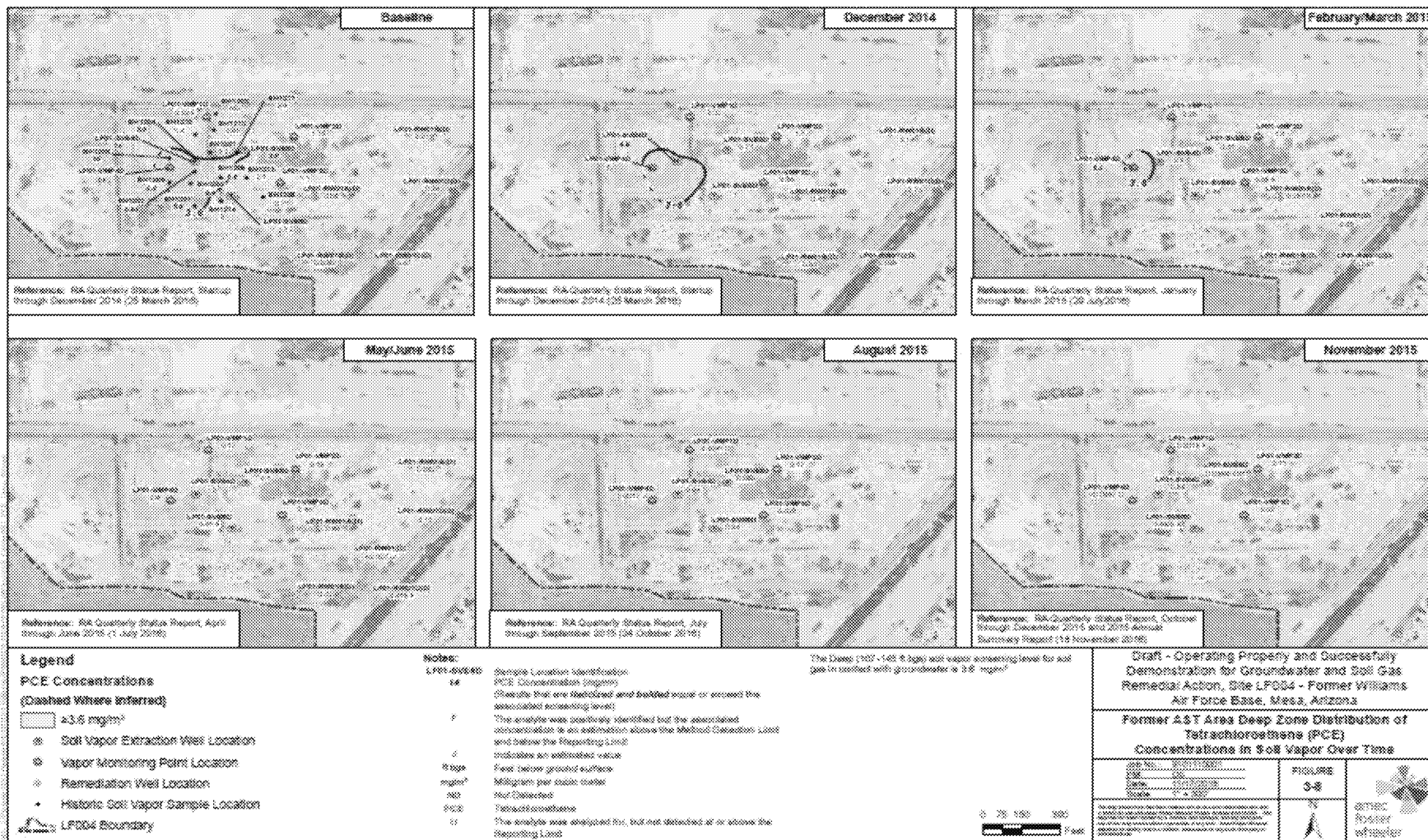


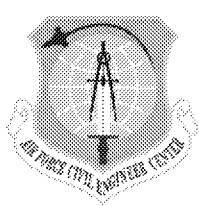
LF004 OPS Update-EPA Comments



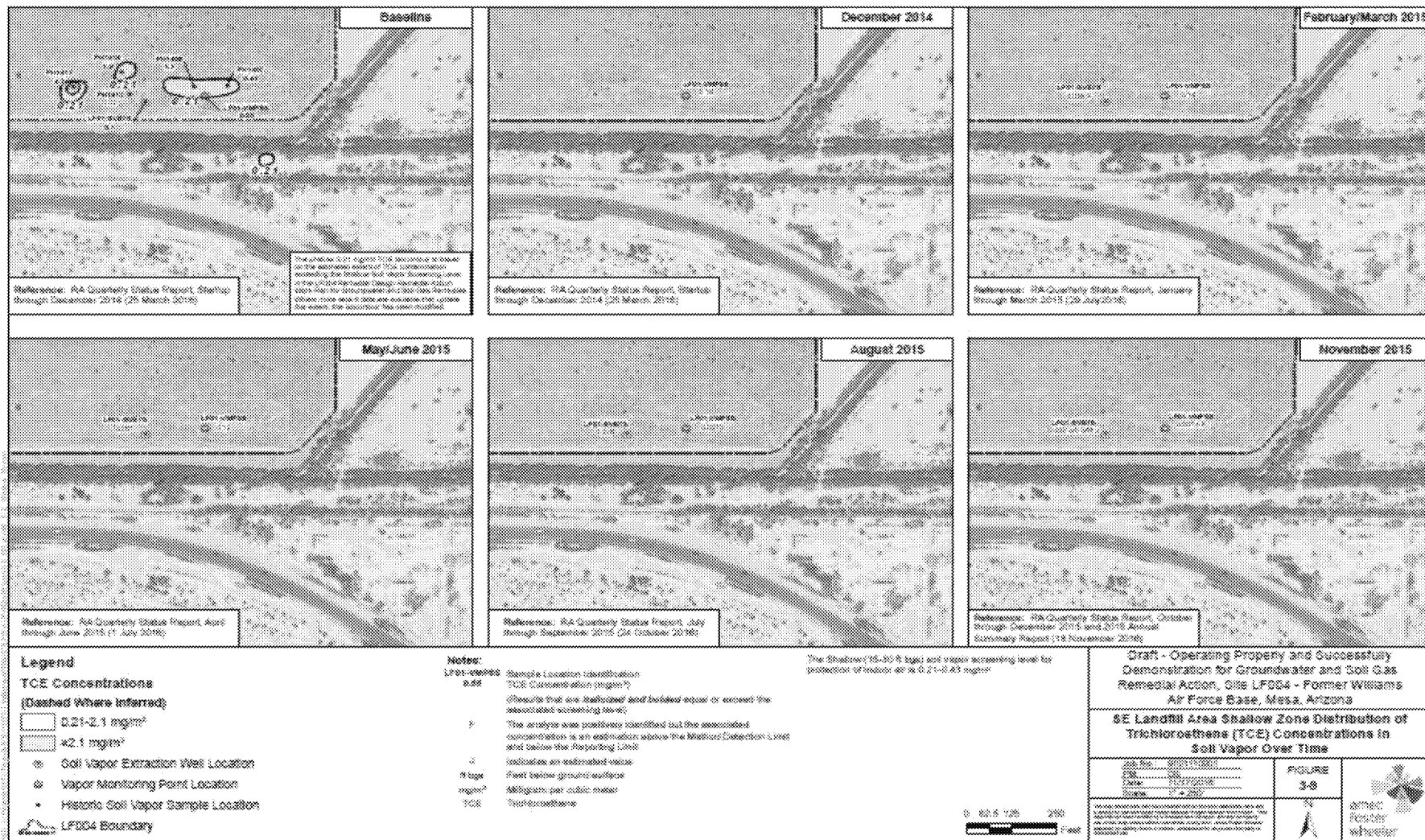


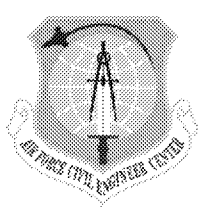
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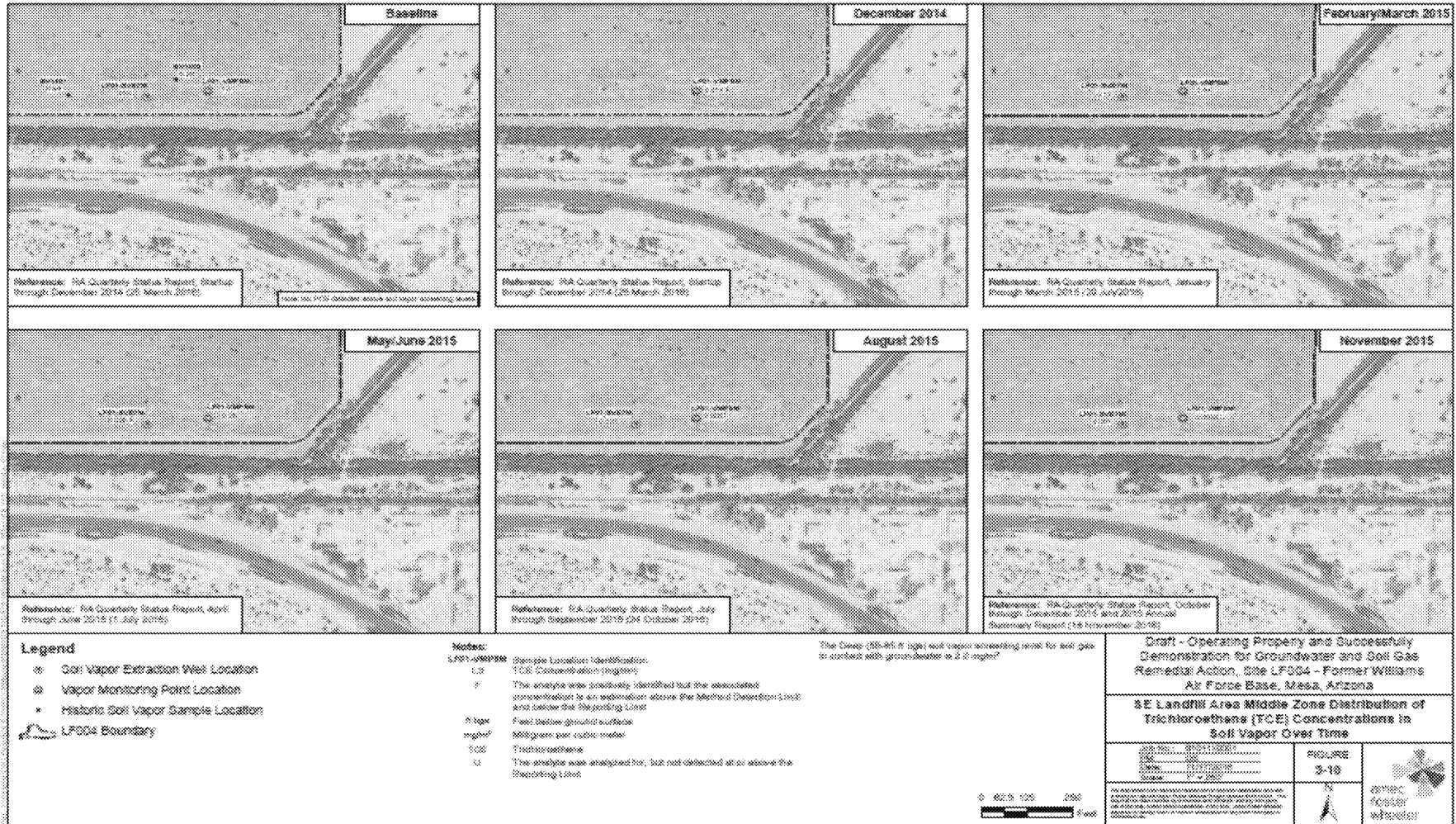


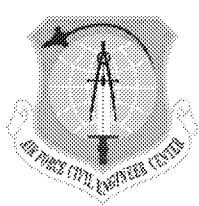
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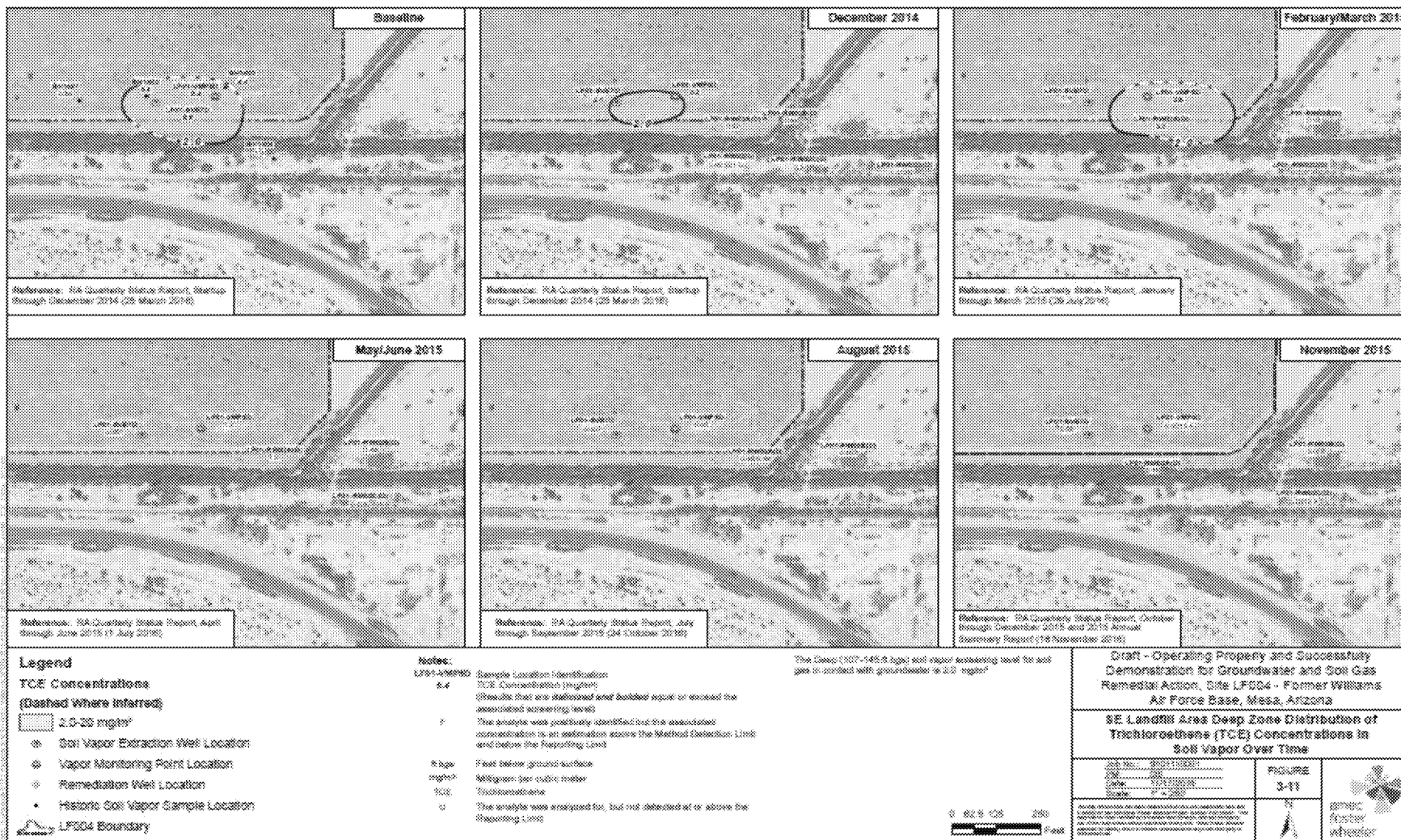


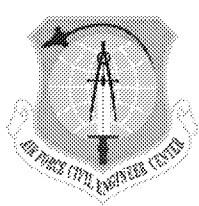
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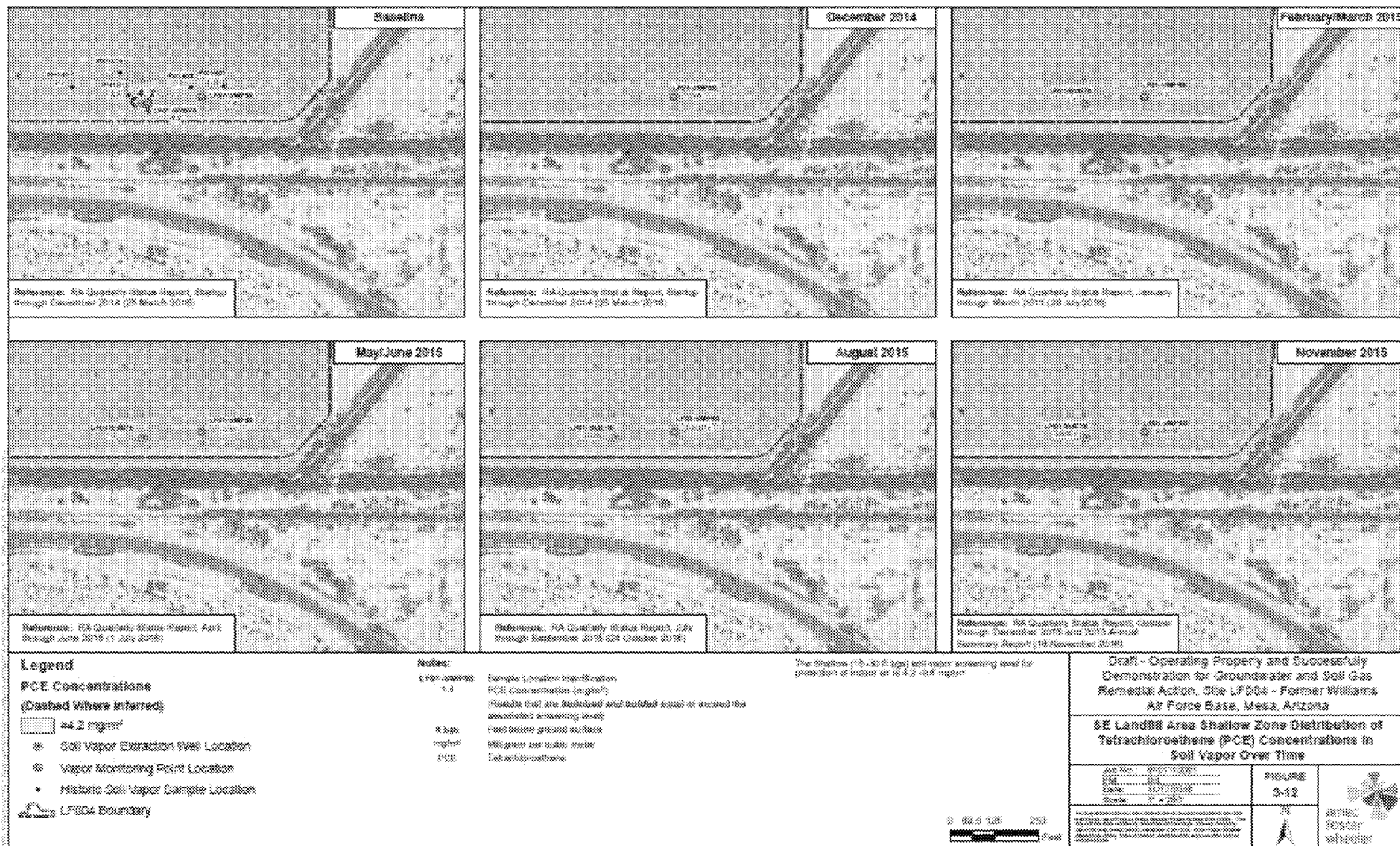


LF004 OPS Update-EPA Comments

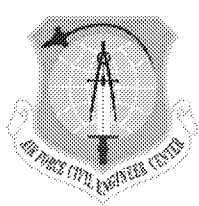




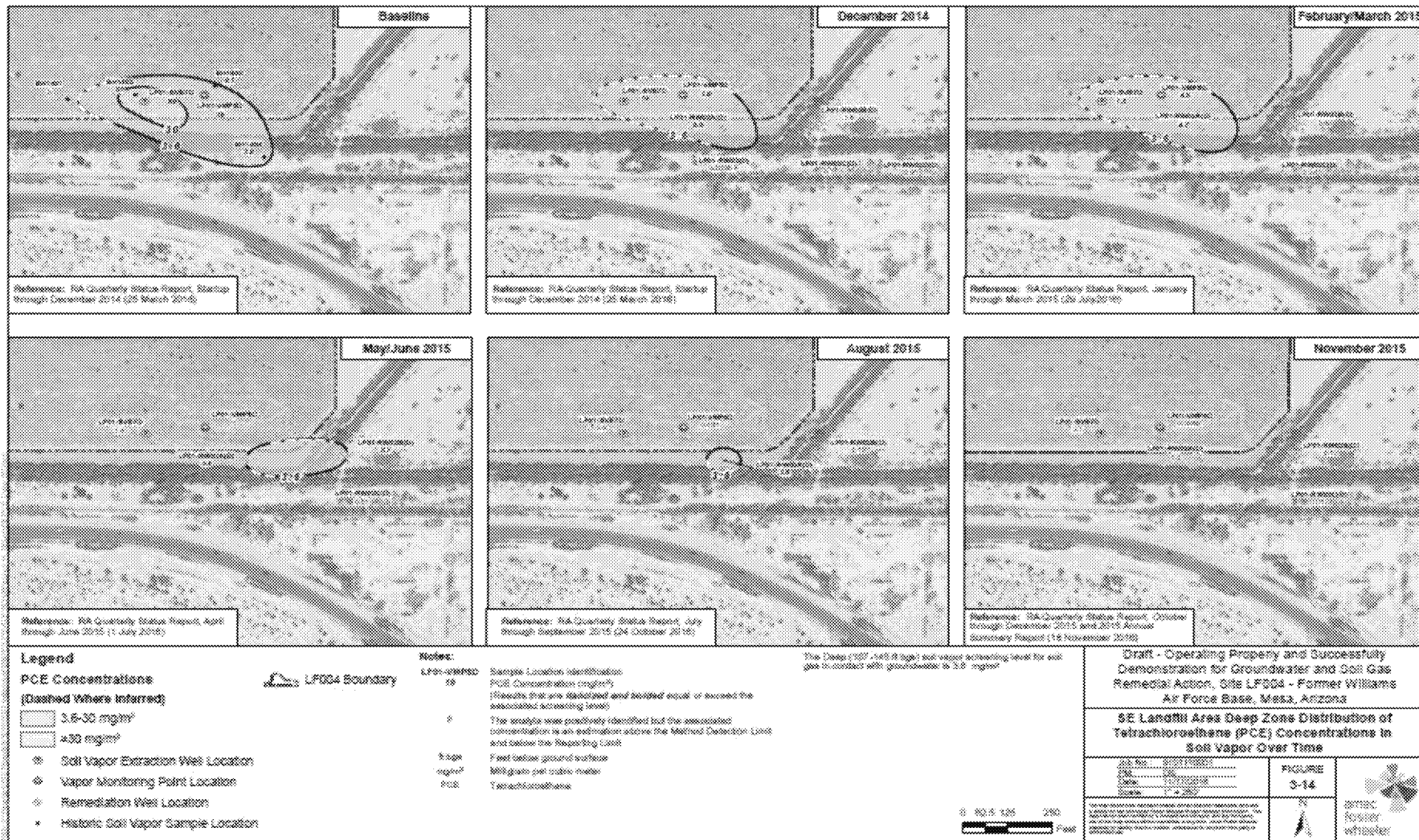
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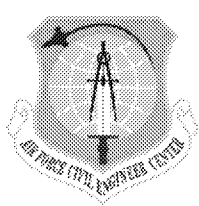




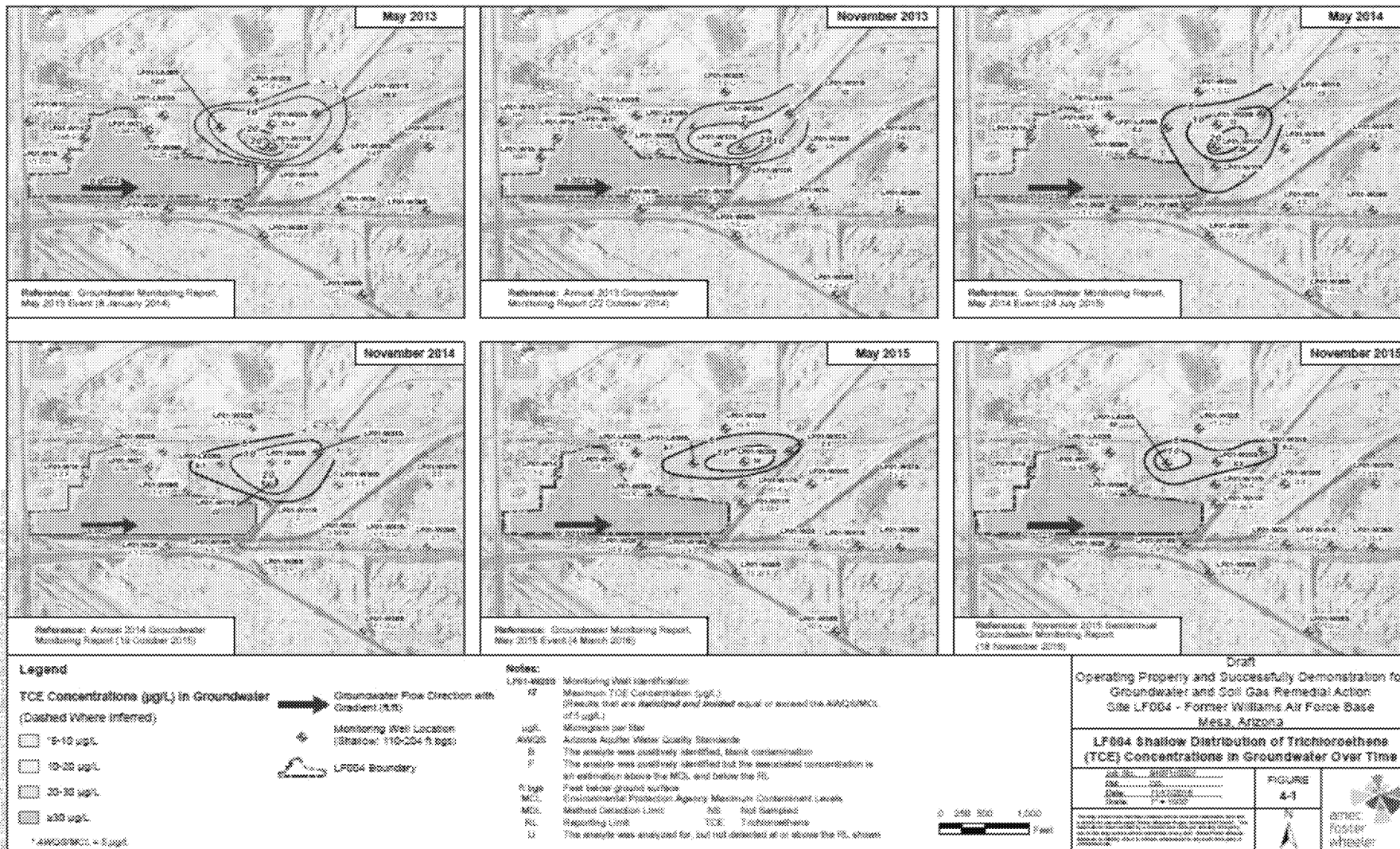


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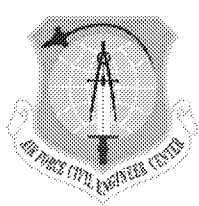


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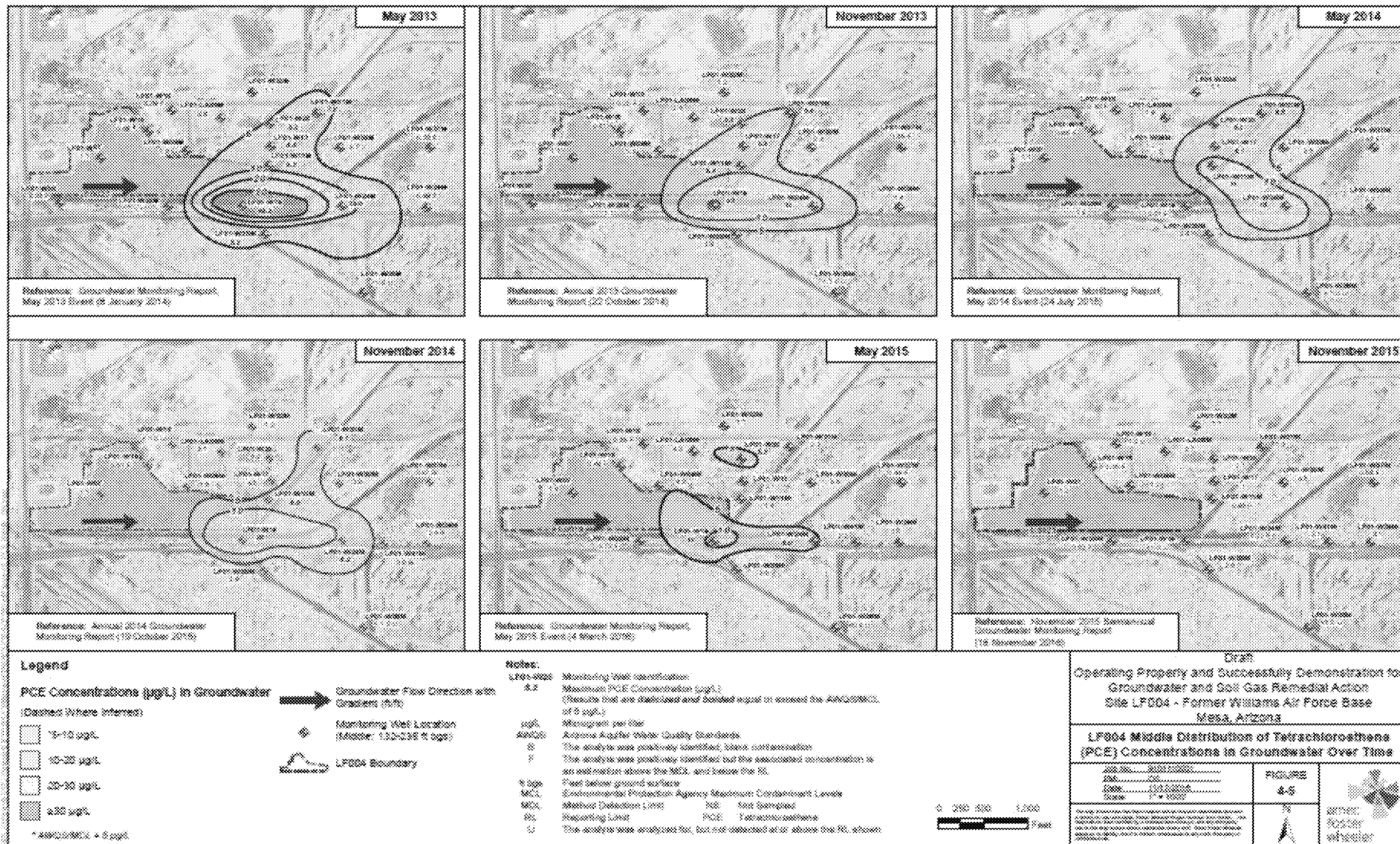


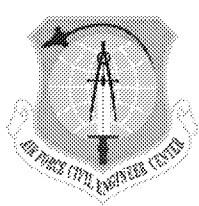




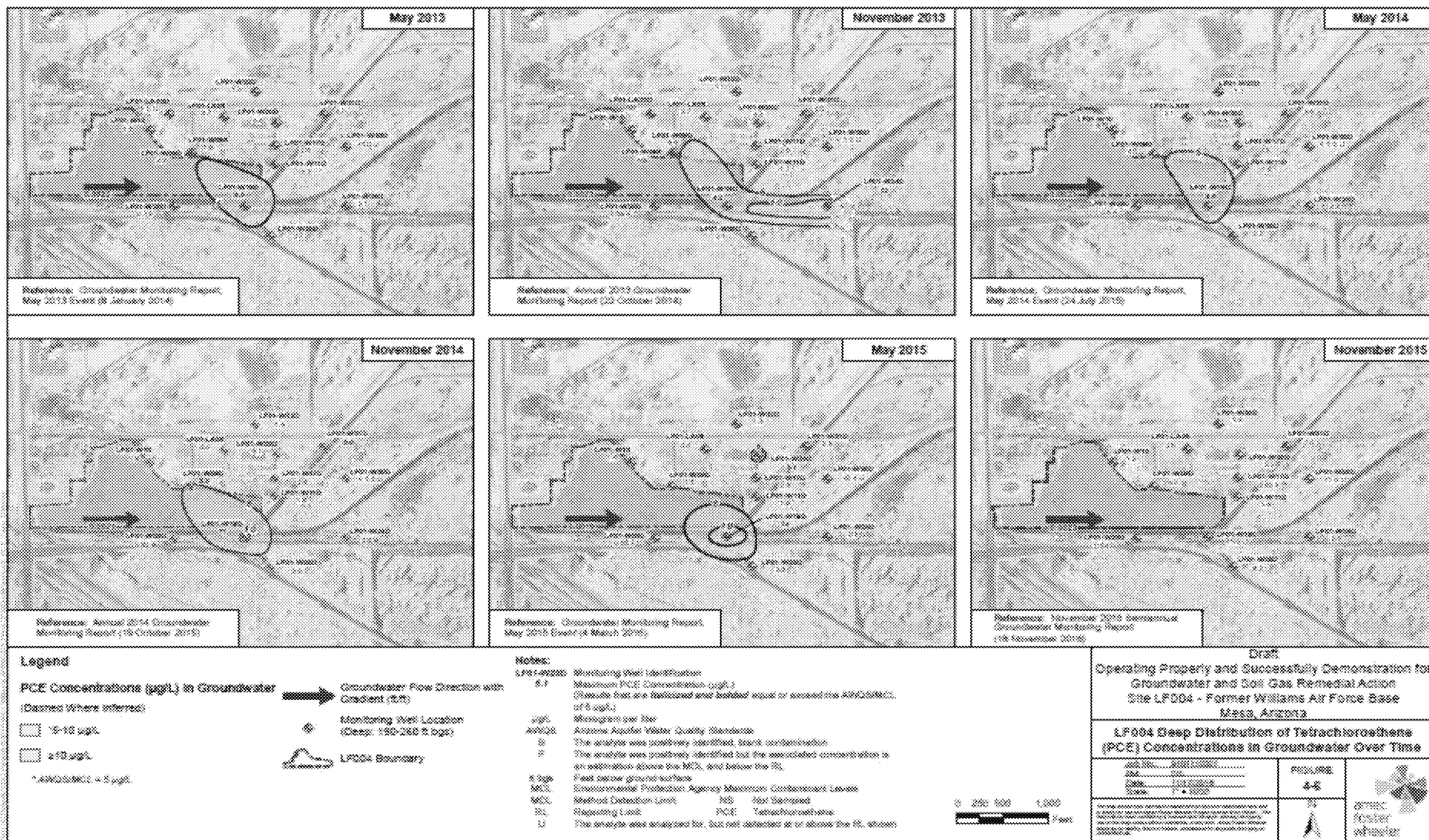


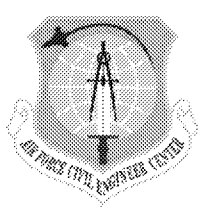
LF004 OPS Update-EPA Comments





LF004 OPS Update-EPA Comments

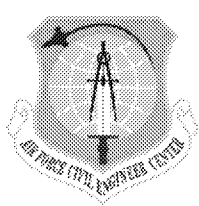




LF004 OPS Update-EPA Comments

- **EPA Comment-Additional site characterization for PFASs in groundwater**

- **AF Response**
- **OPS for landfill was for implementation of the remedial system for treatment of VOCs in soil vapor and groundwater. A PFAS groundwater investigation will be performed by AF at former Williams AFB under a comprehensive national program**



LF004 Remediation System Recent and Upcoming Activities

- Operation of IWAS and Southern Area remediation wells will continue
- Focused extraction at SVE6-D and VMP11-D (AST) by SVE system
- Quarterly vapor samples collected in Dec 2016. Analytical data indicates TCE and PCE concentration remained below soil vapor goals (SVSLs) in all SVE wells and VMPs except TCE in SVE6-D (2.4 mg/m^3 vs 2 mg/m^3) and VMP11-D (6.2 mg/m^3 vs 2 mg/m^3)
- Groundwater sampling of LF01-RW02E followed by oxidant injections in Feb 2017
- Landfill Inspection report under AF review
- Posting of analytical data to Sharepoint will continue as results are available

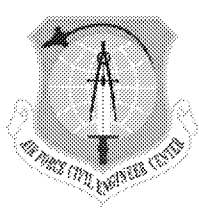
Air Force Civil Engineer Center

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WILLIAMS AIR FORCE BASE*

**Site FT002
Fire Training Area Remedial
Action**

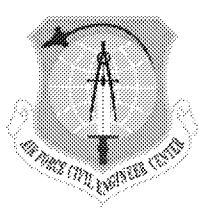


**BCT Meeting
14 February 2017**



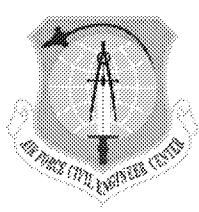
Site FT002 Update

- Received EPA comments for FT002 closure report on Jan 5, 2017
- Received ADEQ comments for FT002 closure report on Feb 6, 2017
- Three main EPA comment categories
 - Additional site characterization for PAHs and VOCs in soil and groundwater
 - Additional site characterization for PFASs in groundwater
 - Clarification regarding data presentation and the use of Johnson Ettinger Model for calculation of site specific sub slab soil vapor remediation goals
- ADEQ comment categories were similar



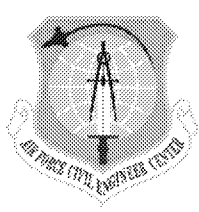
Site FT002 Update-EPA Comments

- EPA Comment-Additional site characterization for PAHs and VOCs in soil and groundwater
- AF Response
- PAHs have been sampled for and not been detected in soil samples. PAHs were subsequently not identified as COCs or COPCs in the RI, FS, Remedial Action Plan (RAP), and Record of Decision (ROD) approved by EPA. Additional soil samples collected in Jan 2013 beneath the WBP and EBP were analyzed for PAHs. PAH concentrations were non detectable or if detected, 5-6 orders of magnitude below RSRLs
- *The soil investigations completed to date have demonstrated that the extent of COC and COPC (VOCs) soil impact above applicable and promulgated regulatory soil levels extended to a maximum pre-remediation depth of 80 feet bgs.*
- Soil samples collected between 80 and 135 feet bgs were below ROD cleanup levels for VOCs.
- Groundwater sampling results did not identify COC and COPC (VOCs) for remediation in the *RI, FS, Remedial Action Plan (RAP), and Record of Decision (ROD) approved by EPA.*
- Additional soil and groundwater investigation for VOCs and PAHs is not warranted.



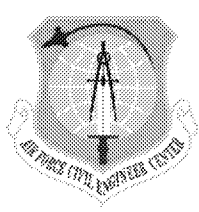
Site FT002 Update-EPA Comments

- **EPA Comment-Additional site characterization for PFASs in groundwater**
- **AF Response**
- **Eastern Burn Pit-PFOS concentrations attenuate rapidly with depth and current reported concentrations in soil at 25 ft bgs are protective of groundwater based on EPA's recent drinking water health advisory level. Alternative PFOA groundwater protective levels will be calculated as requested.**
- ***Western Burn Pit-* PFOS concentrations attenuate rapidly with depth and current reported concentrations in soil below 10 ft bgs are currently protective of groundwater based on EPA's recent drinking water health advisory level. Alternative PFOA groundwater protective levels will be calculated as requested.**
- **A PFAS groundwater investigation will be performed by AF at former Williams AFB under a comprehensive national program**



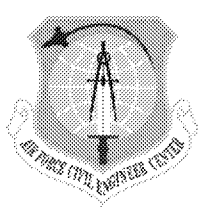
Site FT002 Update-EPA Comments

- EPA Comment-Clarification regarding data presentation and the use of Johnson Ettinger Model for calculation of site specific sub slab soil vapor remediation goals
- AF Response
- Clarification of data and revisions where appropriate will be included in the revised report
- 2015 EPA guidance document, Technical Guide For Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites, is applicable and lists the Johnson & Ettinger Model (JEM) as one of two primary models used to address site-specific soil gas risk calculations. Per the guidance document: *“For sites where PHCs are present and aerobic biodegradation of PHCs occurs in the vadose zone, comparisons to JEM consistently show the model to over-predict indoor air concentrations by at least several orders of magnitude.”* Thus use of the JEM is conservative and likely to be overly protective of potential future residential receptors.



Site FT002 Update-EPA Comments

- **AF Response continued**
- **Model simulations assume the building has a basement and that it is surrounded by homogeneous, uniform sandy soil that is directly exposed to the atmosphere and that preferential pathways for vapor migration into the building or through the vadose zone are not present. The simulations assumed that the square building was 10 meters (33 feet) on each side, which is appropriate for a residential building. These assumptions closely mirror conditions at the Site if a residential building were constructed.**



Site FT002 Path Forward

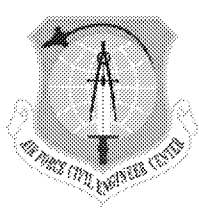
- Prepare written responses to EPA and ADEQ comments.

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Site ST035
Former Building 760**



**BCT Meeting
14 February 2017**



ST035 Path Forward

- Received ADEQ comments for Annual 2015 Groundwater Monitoring Report on Feb 6, 2017. Response to comments in progress
- Received ADEQ comments for Site Closure Report on Feb 6, 2017. Response to comments in progress.
- Site closure is anticipated to be May 2017

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**FORMER
WILLIAMS AIR FORCE BASE
Site SS017
Old Pesticide/Paint Shop**

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14 February 2017**

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BCT GENERAL UPDATE



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2017 BCT MEETINGS/CONFERENCE CALLS SCHEDULE

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ACTION ITEMS

**BCT Meeting
14 February 2017**